Economic Benefits of Transit Systems:

Colorado Case Studies

By Mike Salisbury
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ABOUT SWEEP

The Southwest Energy Efficiency Project is a public interest organization dedicated to advancing energy efficiency in Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming. For more information, visit www.swenergy.org.

SWEEP’s Transportation Program seeks to identify and promote the implementation of policies designed to achieve significant energy savings and reductions in greenhouse gas emissions from the transportation sector. SWEEP’s work focuses on two general strategies: reducing vehicle miles traveled and improving vehicle fuel efficiency.

Questions or comments about this report should be directed to Mike Salisbury, Transportation Program Associate: msalisbury@swenergy.org.
EXECUTIVE SUMMARY

Public transit systems provide important economic benefits in the areas they serve. These benefits are not often quantified, leaving policy makers and the public with little information on whether public transit systems are cost-effective or broadly beneficial. Benefits arising from transit systems may result from increased user benefits (such as reduced travel times and transportation costs), increased mobility (especially for non-drivers) and increased efficiency in the transportation system (less demand for roads or parking).\(^1\) Indirect benefits (such as reduced road congestion) accrue to non-transit users as well, and transit systems can also help shape more compact land use patterns which can have significant economic benefits.

While large metropolitan areas are often perceived as the regions where transit investment produces the most tangible economic benefits, the case studies presented in this report demonstrate that smaller communities also can experience significant economic benefits based on their own investments in local transit systems.

Although the transit systems in Fort Collins, the Roaring Fork Valley and Mesa County (Grand Junction) serve communities of disparate population sizes, geographic areas and demographics, this analysis shows that each of these transit systems generates millions of dollars in economic benefits for their respective regions. The magnitude of the benefits varies widely among communities.

Transfort, the transit service for the city of Fort Collins, serves a population of 144,000 and covers 54 square miles. The majority of its riders are students under the age of 25 and its origins and destinations are focused around the Colorado State University campus. In 2011, it provided 2.2 million rides and a total of 7.5 million passenger miles. In 2011, the total economic benefits from Transfort that we are able to quantify are estimated to be $5.1 million, compared to local financial support (rider fares plus government subsidies) of $5.4 million, which shows an annual net cost to the community of only $300,000. When considering additional benefits which were not quantified for this study, Transfort almost certainly results in net economic benefit for the community.

The Roaring Fork Transportation Authority (RFTA) provides local and regional service along a 68 mile corridor along Interstate 70 and State Highway 82 between Rifle and Aspen. The service area spans three counties and 10 communities and serves a population of over 66,000. Most riders are commuters but there are also many recreational riders accessing ski destinations such as Snowmass and Aspen. In 2011, RFTA provided 4.1 million rides and an estimated 53.7 million passenger miles. The total economic benefits from this transit service in 2011 are estimated at $52.1-63.4 million compared to total local financial support (rider fares plus public investment) of $13.5 million, giving an annual net benefit to the community of $38.6 -$49.9 million. The benefits are very high due to the high price of land in Aspen, which makes parking very expensive, as well as a
large number of employees with very long commutes.

**Grand Valley Transit (GVT)** serves a population of 120,000 covering 66 square miles around the urbanized area of Grand Junction. Its ridership is balanced between commuters, errand runners and students. In 2011, GVT provided 1 million rides and 4.7 million passenger miles. The total economic benefits that we were able to quantify from transit service in 2011 are estimated at $3.9 million, compared to local financial support (rider fares plus government subsidies) of $1.8 million, giving an annual net benefit to the community of $2.1 million.

The case studies analyze economic benefits directly attributable to transit service in each community, such as:

- fuel savings from reduced driving;
- time and fuel savings from reduced congestion;
- income generated from jobs made accessible by transit;
- public benefits saved due to employment; and
- savings to communities from reduced demand for parking.

Additional benefits which may be substantial but were not quantified as part of this analysis due to lack of data include:

- the value of independent living for seniors;
- health benefits of walking or biking to access transit stops;
- health benefits of lowered emissions; and
- increased property values due to the proximity of transit and accident reduction.

Robust transit service can also help shape more compact land use patterns which can have significant economic benefits over time; however, we did not attempt to quantify such benefits. Thus, this study provides a very conservative estimate of the economic benefits associated with public transit.

The most significant benefit identified in each of the case studies is the mobility provided by transit systems which allows workers access to employment. Many employees lack access to personal vehicles and have no viable alternatives to reach their jobs without transit. Without transit service, some people would be unable to hold down jobs and employers would have a smaller pool of potential employees. Some of those without jobs would likely turn to public assistance to support themselves and their families.

In areas with high demand for parking and high land values, transit provides a major benefit by reducing the number of required parking spaces. In the absence of transit, thousands of additional parking spaces would be necessary to accommodate additional vehicle trips. Avoided vehicle trips also result in less gasoline consumption and reduced levels of congestion on major roadways.

This impressive collection of economic and quality-of-life benefits make it clear that transit is much more than just another alternative for going from point A to point B. Because of the significant economic benefits that transit can generate and because many of these benefits accrue to the entire population (not only transit users), communities’ expenditures on transit service should be seen as wise investments in the local economy.
I. FORT COLLINS TRANSIT BENEFITS CASE STUDY

The Transfort transit system serves the city of Fort Collins, Colorado (population 144,000) with 20 fixed bus routes and a paratransit service covering 54 square miles. This case study quantifies several economic benefits that Transfort provides for the city and demonstrates some of the value that a transit system adds to a region.

While benefits from reduced highway maintenance and expansion, land use impacts and greater congestion mitigation are more likely to be realized in larger metropolitan areas, this analysis nevertheless demonstrates that even in small urban communities, increased investment in transit yields significant value to the community. This is due to decreased gasoline and vehicle maintenance costs, congestion avoidance, increased income, reduced parking demand, avoided public assistance benefits and reduced cost of medical trips. The basis for key assumptions as well as the calculations for all figures cited below can be found in the Methodology section below.

Fuel Savings
Transit trips on the Transfort system reduced vehicle miles traveled (VMT) in the region by 2.5 million miles in 2011. This displaced VMT saved 123,800 gallons of gasoline that would have cost $427,000. Less driving also reduces wear and tear and the need for vehicle repair and maintenance which saved drivers an additional $139,000.

Reduced Traffic Congestion
Use of transit helps to reduce congestion in Fort Collins. Without transit service in the region it is estimated that commuters would have spent an additional 39,000 hours delayed by traffic in 2011, which at a value of time of $16.30 per hour would provide a benefit of $634,000. An additional $47,000 was saved by not wasting gasoline while sitting in traffic.

Table 1 | Fort Collins Transit Benefits, 2011

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Savings (Thousand $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline Savings</td>
<td>$427</td>
</tr>
<tr>
<td>Vehicle Maintenance Savings</td>
<td>$139</td>
</tr>
<tr>
<td>Reduced Traffic Congestion Savings</td>
<td>$681</td>
</tr>
<tr>
<td>Reduced Cost of Medical Trips</td>
<td>$39</td>
</tr>
<tr>
<td>Reduced Parking Infrastructure Cost</td>
<td>$1,384</td>
</tr>
<tr>
<td>Avoided Public Assistance Payments</td>
<td>$150</td>
</tr>
<tr>
<td><strong>Total Transit Benefit</strong></td>
<td><strong>$2,821</strong></td>
</tr>
<tr>
<td>Income from Employment Accessible by Transit</td>
<td><strong>$2,324</strong></td>
</tr>
<tr>
<td><strong>Total Transit Benefit with Employment Benefit</strong></td>
<td><strong>$5,145</strong></td>
</tr>
</tbody>
</table>

*Totals may not match figures due to rounding.
**Access to Work and Other Key Destinations**

One of the most important mobility benefits provided by transit is its ability to provide people with access to employment. Onboard surveys conducted by Transfort indicate that 14% of transit riders use the system to commute to their job. Based on the average household income of transit riders, the total annual wages earned by transit riders is $11.6 million. If 10% of commuters (98 daily riders) could not access employment without transit they would stand to lose $2.3 million in annual wages. Most of these lost wages would be acquired by others filling the jobs and therefore would not be a net loss to the region; therefore the employment benefit is not grouped with the other benefits in Table 1. However, this is still an important economic benefit that we felt should be represented.

In addition to these lost wages, some of the unemployed would likely turn to public assistance to supplement their income requiring up to an additional $150,000 in public assistance payments.

An additional mobility benefit is the lower cost of using fixed route or paratransit services to make important trips. Trips for medical services (which tend to be less discretionary than other types of trips) make up approximately 2% of the system’s trips. If 11.7% of these medical trips are shifted to taxi service this would cost those riders an additional $39,000.

**Reduced Parking Infrastructure Cost**

Without transit service to serve Colorado State University and the downtown, additional parking would be necessary to accommodate the thousands of extra trips each day into this area. The annual cost to add an additional parking structure in the city to meet this demand would be approximately $1.4 million.

**Distribution of Benefits**

It is important to note that the benefits identified accrue not only to transit riders but also to the general public. The benefits of reduced congestion, avoided public assistance payments and reduced parking infrastructure costs, totaling $2,215,000, are shared by the entire community.

**Non-Quantified Benefits**

Additional benefits from transit service that have not been quantified in this case study include:

- the value of seniors able to live independently at home rather than moving to assisted living facilities or nursing homes;
- the value of health benefits due to transit riders walking or biking to and from bus stops;
- savings related to accident reduction and safety improvements;
- increased value of real estate in areas with good transit service; and
- the value of health benefits associated with fewer air pollutants and greenhouse gas emissions reductions.

As methodologies for analyzing these benefits advance and more information is collected, it may become possible to quantify these benefits in future studies.
Local Investment and Net Benefit
Local (as opposed to federal) financial investment for the Transfort system in 2011 totaled $5.4 million. $1.1 million came from fares and the remaining $4.3 million came from local taxes. Thus the local economic benefits we were able to estimate (including the employment access benefit) are approximately equal to the local investment, with an annual net cost to the community of only $300,000. When considering additional benefits which were not quantified for this study, Transfort almost certainly results in net economic benefit for the community.

Methodology

VMT Reduction
The total Passenger Miles Traveled (PMT) on the transit system was used to determine how much vehicle driving is replaced by transit. Specific information on how transit users would change their travel plans if transit service was discontinued was not available as part of Transfort’s Bus Rider Survey.

Based on data from the Transit Performance Monitoring System (TPMS), the American Public Transportation Association (APTA) developed default mode shift factors to represent how transit users would behave without transit service. The mode shift factor for “small” agencies (with service populations less than 500,000) is 0.34, meaning that every passenger mile of transit travel displaces 0.34 VMT. APTA’s analysis also provided a more detailed breakdown of exactly which mode of transportation (such as car, bike or walking) will be used in the face of discontinued transit service in small agencies, as shown in Table 2.

It is important to note that this may significantly underestimate the actual reduction in VMT due to the transit service provided by Transfort. Many of the VMT reduction benefits of public transit arise due to the synergistic effects that transit has on land use. In most small town systems there is not enough of a transit presence to shape where people live, or have a broader impact on land use. In the case of Fort Collins, the transit service is extensive enough that it likely does have a significant impact on, for example, housing choices by students and downtown employees. As students and employees choose to live in transit accessible locations, it is likely that they also take more trips by walking and cycling, and have shorter average trip lengths when driving. Several studies argue that there is a transit multiplier effect, in which actual VMT savings are in fact significantly greater than PMT on the transit system.  

Table 2 | Mode or Trip Choice by Transit Users if Transfort Transit Service Were Discontinued

<table>
<thead>
<tr>
<th>Mode Choice</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>12.8%</td>
</tr>
<tr>
<td>Walk</td>
<td>26.8%</td>
</tr>
<tr>
<td>Ride with someone</td>
<td>22.8%</td>
</tr>
<tr>
<td>Taxi</td>
<td>11.6%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>4.5%</td>
</tr>
<tr>
<td>Not make trip</td>
<td>21.5%</td>
</tr>
</tbody>
</table>

While the APTA mode shift factor and mode choices may not accurately reflect the reality of the Transfort system and its users, it is difficult to make more accurate assumptions without survey data to better understand local behavior.

Based on one passenger mile of transit replacing 0.34 VMT, 7.5 million PMT on the
Transfort system replaced 2.5 million VMT. Based on the 2011 average light duty vehicle fuel efficiency of 20.5 miles per gallon, the reduction of 2.5 million VMT saved 123,816 gallons of gasoline. Based on the average statewide price of gasoline in 2011, $3.45 per gallon, this saved drivers $427,167.

Reducing VMT also reduces some vehicle maintenance costs such as the need for routine tune-ups and replacement tires. Costs such as insurance, license and registration fees and depreciation are not considered as they are not as directly affected by reduced mileage. The average per-mile cost for routine maintenance is $0.045 and for tires is $0.01. Multiplying the reduced VMT by $0.055 saves drivers $139,248.

In addition to the travel time savings created by the transit system, there are fuel savings from less time spent in congested traffic. TTI estimates that in small urban areas one transit trip saves 0.006 gallons of gasoline due to reduced congestion. Multiplying the number of trips on Transfort (2,194,727) by 0.006 gallons gives a total fuel use reduction of 13,717 gallons and a savings of $47,324.

**Reduced Traffic Congestion**

The Texas Transportation Institute (TTI) publishes an annual Urban Mobility Report which assesses the impacts of congestion on urban areas across the United States. Although Fort Collins is not included in their assessment, the methodologies from the report can be applied to the region to estimate the value of transit service in reducing congestion. The assumptions made for small urban areas (less than 350,000 residents) are used for this analysis. Based on Fort Collins population of 143,986 and the ratio of population to commuters being 2.2 to 1, there are approximately 64,859 commuters in the city. TTI estimates that for small urban areas the annual delay would increase by 36 minutes a year if transit service was discontinued, resulting in an additional 38,915 hours of delay. The value of driver’s time in small urban areas was estimated at $16.30 per hour by TTI (which is on the high end of a reasonable valuation of the cost of time in congestion). When multiplied by the total hours of additional delay, this results in transit saving drivers $634,317 by reducing congestion. These savings do not include the additional value of time savings for commercial vehicles (which have much higher time values).

**Access to Work and Other Key Destinations**

The Transfort Bus Rider Survey estimates that 14% of transit riders use the service for commuting to work. Based on average daily ridership of 7,003, 980 of these riders are work commuters. To determine the average annual household income of all transit riders, the means of the ranges of values given in the Bus Rider Survey were multiplied by the percentage found in that income range, resulting in an average annual household income of $23,700. Multiplied by the total number of commuters we estimate total annual wages for all transit commuters as $23,235,954. The APTA report estimates that 21.5% of trips currently made on transit would not take place at all without transit service. Assuming that work trips are higher priority than other trips, we estimate that only 10% of work trips on transit would not take place. If 10% of commuters were unable
to maintain their employment, they would lose out on $2,323,595 in wages.

With less access to employment due to lack of transit, some of these individuals might turn to public assistance to supplement their income. For this analysis, we assume that 25% of potentially unemployed individuals would rely on public assistance. For two-adult families, Colorado offers an average monthly TANF (Temporary Aid to Needy Families) benefit of $510 (or $6,120 over twelve months). If 25% of the individuals unemployed due to lack of transportation received this amount of public assistance over the course of a year, the cost would be $150,004. Thus the total employment benefit of transit would equal the lost wages plus the avoided public assistance payments, for a total of $2,473,600.

**Less Expensive Trips**

An additional mobility benefit is the low cost service that the Transfort system provides compared to a likely alternative for those without access to a vehicle, which would be taxi service. A round trip fare on Transfort costs $2.50 or $0.37 per mile if the average trip is 3.4 miles in length. To make the same trip in a local taxi service would be significantly more expensive. Yellow Cab of Northern Colorado charges $3.50 for the first passenger and the first one-ninth mile of the trip and then $2.25 per mile for each additional mile. To make the same 6.8 mile round trip would cost $17.80, $15.30 more than via transit.

Many without access to a vehicle are unlikely to be able to afford to make a significant number of trips using taxis, which would result in a large number of trips that would shift to other modes or be repressed. Medical trips, which can be less discretionary, account for 2% of all transit trips or 21,947 total round trips (43,895 total unlinked trips). While many medical trips would be repressed, shifted to more convenient locations or reached via carpooling or other alternative means, some number of these trips would need to shift to taxi service to take place. Based on the APTA report (as shown in Table 2), we assume that in the absence of transit service, 11.7% of medical visits (2,567) would shift to taxi service. Based on the differential cost of a transit trip and a taxi trip, this would result in medical patients paying an additional $39,288 in transportation costs.

**Reduced Parking Infrastructure Cost**

Transfort’s ability to provide easy access to Colorado State University and downtown Fort Collins for students, employees, and shoppers significantly reduces parking demand. Based on a daily ridership of 7,003 and the mode shift estimates in Table 2, an estimate can be made of the number of additional parking spaces necessary if transit service ceased to operate. Of current transit users, an estimated 896 would drive alone (7,003*12.8%) and 1,597 would carpool (7,003*22.8%) with which an average carpool occupancy of 2.5 would result in 639 additional vehicles. Therefore, an additional 1,535 vehicles would need to park in Fort Collins if there was no transit service. Transit destinations are spread across the city, but are concentrated at Colorado State University and the areas west of campus. It is not possible to determine exactly the proportion of additional demand in this area, but 750
spaces seems a reasonable lower bound estimate for the number of new structured parking spaces necessary.

Colorado State University built the 900-space Lake Street Garage (on West Lake St. and Centre Ave.) in 2010 at a cost of $21.6 million, or $24,000 per space. The Lake Street Garage was a Certified LEED Gold building so the costs are probably on the higher end, but it is within the range of cost estimates provided by the city (between $18,000 and $25,000 per space). If the middle of the range is used, $21,500 per space, the annualized cost per space (including O&M costs of $400 per space per year) would be $1,845 or $1,383,750 for 750 spaces.

Local Investment
To determine how much local (as opposed to federal) funding was used to support transit, we used figures from the National Transit Database on the total amount of local funds spent on operating and capital costs, plus the fare revenue collected from customers. Because capital costs can vary significantly each year, a five year average was used. In 2011, Transfort collected $1,137,405 in fare revenues and collected $3,972,181 in local tax funds to support operating expenses. The average (2007-2011) for local funds invested in capital costs was $318,106. Thus the total local cost was about $5.4 million in 2011.
II. ROARING FORK TRANSPORTATION AUTHORITY CASE STUDY

The Roaring Fork Transportation Authority (RFTA) system serves a population of over 66,000 with local and regional service in communities along 41 miles of Colorado’s Highway 82 corridor between Glenwood Springs and Aspen and along 27 miles of Interstate 70 between Glenwood Springs and Rifle. This case study quantifies several economic benefits that the RFTA system provides for the region. The analysis demonstrates that increased investment in transit on regional systems can yield significant value to communities due to decreased gasoline and vehicle maintenance costs, reduced traffic congestion, better access to employment, avoided public assistance benefits and reduced parking demand. The basis for key assumptions as well as the calculations for all figures cited below can be found in the Methodology section below.

Table 3 | RFTA Transit Benefits, 2011

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Savings (Thousands $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline Savings</td>
<td>$3,289</td>
</tr>
<tr>
<td>Vehicle Maintenance Savings</td>
<td>$1,072</td>
</tr>
<tr>
<td>Reduced Traffic Congestion</td>
<td>$656</td>
</tr>
<tr>
<td>Avoided Public Assistance Payments</td>
<td>$1,576</td>
</tr>
<tr>
<td>Reduced Parking Infrastructure Cost</td>
<td>$2,527 - $13,827</td>
</tr>
<tr>
<td><strong>Total Transit Benefit</strong></td>
<td><strong>$9,122 - $20,422</strong></td>
</tr>
<tr>
<td>Income from Employment Accessible by Transit</td>
<td>$42,982</td>
</tr>
<tr>
<td><strong>Total Transit Benefit with Employment Benefit</strong></td>
<td><strong>$52,105 - $63,405</strong></td>
</tr>
</tbody>
</table>

*Totals may not match figures due to rounding.

Fuel Savings

Transit trips on the RFTA system reduced vehicle miles traveled (VMT) by 19.6 million miles in 2011, saving 953,000 gallons of gasoline worth $3.3 million. Less driving also reduces wear and tear and the need for vehicle repair and maintenance, saving drivers an additional $1 million.

Reduced Traffic Congestion

Use of transit removes vehicles from the road which helps to reduce congestion in the Highway 82 corridor. Without transit service in the region it is estimated that additional congestion would cost drivers $650,000.

Access to Work

One of the most important mobility benefits provided by transit is its ability to provide people with access to employment. Onboard surveys indicate that 68% of RFTA’s riders use the system to commute to their job. Based on the average household income of transit riders, the total annual wages earned by transit riders would be $140 million. If
15% of commuters (1,303 daily riders) would not be able to get to their job without transit they would stand to lose $43.0 million in annual wages.

Some of these lost wages would be acquired by others filling the jobs and therefore would not be a net loss to the region; therefore the employment benefit is not grouped with the other benefits in Table 3. For the RFTA region, however, transit plays a critical role in matching employees to employment opportunities along the Highway 82 and I-70 corridors. Without transit it would be very difficult for many of these jobs to be filled, which could contribute to higher labor costs and the need for more affordable housing closer to employment centers. While there are uncertainties about the scope of this benefit this is still an important economic benefit that we felt should be represented.

In addition to these lost wages, some of the unemployed would likely turn to public assistance to supplement their income. Providing basic assistance to these unemployed workers would cost up to an additional $1.6 million in public assistance payments.

### Reduced Parking Infrastructure Cost

Without transit service to serve destinations such as Aspen and Snowmass Village, additional parking would be necessary to accommodate the thousands of additional vehicles trips into these areas. If land costs are absorbed by ground level commercial or residential properties, the total annual cost for three 480-space garages to accommodate additional commuters would be between $2.5 and $3.3 million depending on if the garage is built aboveground or belowground. If land costs are fully borne by the garage, annualized cost would be $13.8 million.

### Distribution of Benefits

It is important to note that the benefits identified above, totaling $5.6 - $16.9 million, accrue not only to transit riders but also to the general public. The benefits of reduced congestion, avoided public assistance payments, reduced road maintenance costs and reduced parking infrastructure costs are shared by the entire community.

### Non-Quantified Benefits

Additional benefits from transit service that have not been quantified in this case study include:

- the value of seniors able to live independently at home rather than moving to assisted living facilities or nursing homes;
- the value of the improved access to health care offered by transit service;
- the value of health benefits due to transit riders walking or biking to and from bus stops;
- savings related to accident reduction and safety improvements;
- the avoided cost of having to build new highway lanes to accommodate greater travel demand;
- increased value of real estate in areas with good transit service; and
- the value of health benefits associated with fewer air pollutants and greenhouse gas emissions reductions.

As methodologies for analyzing these benefits advance and more information is collected, it...
may become possible to quantify these benefits in future studies.

While the benefit of decreased parking demand is quantified in this analysis, additional considerations around land use are also important to consider for destinations such as Aspen and Snowmass Village. If new parking areas were added (which could be a challenge due to lack of readily available land) this would likely have an impact on already-high housing costs in this area. The use of transit also encourages walking in these destinations which helps support retailers who rely on high foot traffic around their shops to bring in customers.

**Local Investment and Net Benefit**
Local investment in the RFTA system totaled $13.5 million dollars in 2011 ($9.9 million from local taxes and $3.6 million from collected fares). Thus the net economic benefits from public transit in the Roaring Fork Valley greatly exceed the local investment when the employment benefit is included ($38.6 - $49.9 million), and potentially exceed the local investment when employment benefits are excluded (between a net cost of $4.4 million and a net benefit of $6.9 million).

**Methodology**

**VMT Reduction**
The total Passenger Miles Traveled (PMT) on the transit system was used to determine how much vehicle driving is replaced by transit. Specific information on how transit users would change their travel plans if transit service was discontinued was not available as part of RFTA’s Passenger Opinion Survey, therefore national averages were used.

Based on data from Transit Performance Monitoring System (TPMS), the American Public Transportation Association (APTA) developed default mode shift factors to represent how transit users would behave without transit service. The mode shift factor for “small” agencies (with service populations below 500,000) is 0.34, meaning that every passenger mile of transit travel displaces 0.34 VMT. APTA’s analysis also provided a more detailed breakdown of exactly which mode of transportation (such as car, bike or walking) will be used in the face of discontinued transit service in small agencies as shown in column 2 of Table 4.

<table>
<thead>
<tr>
<th>Mode Choice</th>
<th>Percentage</th>
<th>Reweighted Percentage for Regional Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>12.8%</td>
<td>22.4%</td>
</tr>
<tr>
<td>Walk</td>
<td>26.8%</td>
<td>0%</td>
</tr>
<tr>
<td>Ride with someone</td>
<td>22.8%</td>
<td>39.9%</td>
</tr>
<tr>
<td>Taxi</td>
<td>11.7%</td>
<td>0%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>4.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Not make trip</td>
<td>21.5%</td>
<td>37.6%</td>
</tr>
<tr>
<td>Mode shift factor</td>
<td>0.34</td>
<td>0.38</td>
</tr>
</tbody>
</table>

However, due to the regional nature of many trips on the RFTA system it is unlikely that many transit trips could be replaced by walking, biking and taxi trips. Therefore the percentages for trip displacement for longer, regional trips have been reweighted to shift the 43% of walking, biking and taxi trips to the remaining options (based on the initial
proportion of those other options). The mode shift factor for regional trips is 0.38.

For regional trips, PMT on transit is estimated by multiplying regional ridership in 2011 (1,875,380)\textsuperscript{25} by 16 miles\textsuperscript{26} to get 30,006,080 PMT. The remaining trips on the system (2,262,525) average 10.5 miles per trip and result in 23,786,685 PMT. Regional trips with a mode shift factor of 0.38 displace 11,518,972 VMT and local trips with a mode shift factor of 0.34 displace 8,087,473 VMT for a total displacement of 19,606,444 VMT.

Based on the 2011 average light duty vehicle fuel efficiency of 20.5 miles per gallon,\textsuperscript{27} the reduction of 19.6 million VMT would save 953,621 gallons of gasoline. Based on the average statewide price of gasoline in 2011 ($3.45 per gallon)\textsuperscript{28} drivers would save $3,289,992 in avoided fuel costs. (This is likely to underestimate the savings, as the price of gasoline in RFTA’s service area is consistently higher than the state average.)

Reduced VMT also reduces vehicle maintenance costs such as the need for routine tune-ups and replacement tires. Costs such as insurance, license and registration fees and depreciation are not considered as they are not as directly affected by reduced mileage. The average per mile cost for routine maintenance is $0.045 and for tires is $0.01.\textsuperscript{29} Multiplying the reduced VMT by $0.055 saves drivers $1,072,473.

**Reduced Traffic Congestion**

The Federal Highway Administration (FHWA) estimates a range of the cost of congestion for each vehicle type for both rural and urban highways.\textsuperscript{30} As the Highway 82 corridor has aspects of both rural and urban highways, the “all highways” figures have been used. Buses have a congestion cost of $0.0843 per mile and automobiles have a cost of $0.0448 per mile. Based on average bus and light-duty vehicle occupancy rates (14 and 1.63, respectively), a bus is expected to displace 8.6 automobiles. Therefore, the net savings per bus mile would be $0.30 [(8.6 * $0.0448) - $0.0843]. The total bus miles in the Highway 82 corridor in 2011 was 2,184,773\textsuperscript{31} giving a total congestion reduction benefit of $656,492.

**Access to Work**

The RFTA Passenger Opinion Survey shows that 68.3\% of riders use the system for commuting to and from work.\textsuperscript{32} Based on a ridership of 4,137,905, there would be 2,826,189 trips due to commuting (or 1,413,095 round trips). To determine the number of commuters, the number of round trips is divided by the average number of annual working days (210), which gives 6,729 commuters. Based on data from the Passenger Opinion Survey, 4,051 of these are regional commuters making longer trips and 2,678 are local commuters.\textsuperscript{33}

To determine the average annual household income of all commuting riders, the means of the ranges of values given in the Passenger Opinion Survey were multiplied by the percentage found in that income range, resulting in an average annual household income of $41,712.\textsuperscript{34} For local commuters, the APTA report cited in Table 4 states that 21.5\% of trips currently made on transit would not take place at all without transit service.
Assuming that work trips would be a higher priority than other trips, we estimate that only 10% of local work trips on transit would not take place, meaning 268 local commuters would be unable to get to work. For regional commuters, with fewer alternatives (unable to walk, bicycle or take a taxi) APTA’s numbers suggest that 37.6% of trips would not take place without transit. Again, assuming the importance of work trips, we estimate that 18%, or 762 regional commuters would be unable to get to work without transit. The total of 1,030 local and regional commuters (or 15% of all commuters) unable to maintain employment would lose out on $42,982,429 in wages.

With less access to employment due to lack of transit, some of these individuals might turn to public assistance to supplement their income. For this analysis, we have assumed that 25% of these potentially unemployed individuals would rely on public assistance. For two adult families, Colorado offers an average monthly TANF (Temporary Aid to Needy Families) benefit of $510 (or $6,120 over twelve months).35 If 25% of the individuals unemployed due to lack of transit received this amount of public assistance over the course of a year, the cost would be $1,576,599. Thus the total employment benefit of transit would equal the lost wages in addition to the avoided public assistance payments for a total of $44,559,029.

**Reduced Parking Infrastructure Cost**

One significant benefit provided by transit in the Roaring Fork Valley is that it reduces demand for parking at key destinations such as Aspen and Snowmass Village. Transit’s ability to provide easy access to these destinations for employees, recreational users and errand runners reduces parking demand in Aspen by more than 1,000 spaces. There are an estimated 4,307 employees using transit to arrive at their job in Aspen each day;36 2,812 of these are regional commuters and 1,494 are local commuters. Based on the different mode shift factors for regional and local travelers shown in Table 4, it is estimated that, if transit service was discontinued, 822 commuters would drive alone and 1,464 would carpool in 585 vehicles (with an average occupancy of 2.5 people per carpool). This results in an additional 1,407 vehicles coming into Aspen each day that would require parking spaces.

To accommodate these additional vehicles Aspen would need to build new structured parking garages and the costs could be significant due mainly to the high cost of land.37 A survey of commercial real estate listings in downtown Aspen shows that the average price per square foot of land is $1,348,38 which translates to approximately $58.7 million per acre. A four-level parking structure on one acre of land could provide approximately 480 parking spaces; three garages of this size would be needed to meet new parking demand just for commuters who currently rely on transit. Construction of the structure would cost approximately $8.6 million, or $18,000 per space, and annual operating and maintenance (O&M) costs would be approximately $288,000, or $600 per space. The total annualized cost would be $9,602 per space, or $4.6 million for one garage and $13.8 million for three garages.39 Note that construction costs may be higher than assumed here, as costs in Aspen are generally higher than the rest of the state.
Alternatively, structured parking could be built which would allow for commercial or residential uses on the ground level area (allowing land costs to be recouped). With slightly higher construction costs of $9.6 million (an additional level would increase costs to $20,000 per space) and the same O&M costs, the total annualized costs would be $842,400 for one structured garage and $2.5 million for three structured garages.

Building an underground lot would perhaps fit better with the aesthetic small town look of Aspen but would require a higher construction cost of $12 million ($25,000 per space), again assuming that land costs could be recovered with ground level commercial or residential properties. Total annualized construction and operating and maintenance costs for an underground lot would be $2,304 per space or $1.1 million for one garage or $3.3 million for three garages.

**State Highway Construction**

In the State Highway 82 corridor, it would be very difficult and expensive to expand the highway due to geographic and environmental constraints. The cost of expanding certain sections of the corridor to four lanes was over $30 million per highway mile in a 2003 Corridor Investment Study conducted by the Colorado Department of Transportation.\(^40\) For comparison, the total capital cost of the VelociRFTA Bus Rapid Transit project is $46 million.\(^41\) While there is not sufficient information available to quantify this benefit, it is expected to be substantial.

**Local Investment**

In 2011, RFTA received $9,935,860 in local taxes and collected $3,580,361 in fares from customers, for total of $13.5 million local (as opposed to federal) investment in transit.
III. GRAND VALLEY TRANSIT BENEFITS CASE STUDY

The Grand Valley Transit system serves approximately 120,000 residents of the city of Grand Junction and several smaller surrounding communities (covering 66 square miles) with eleven fixed route bus lines as well as paratransit and a Dial-a-Ride service. This case study quantifies several economic benefits and demonstrates some of the value that the Grand Valley Transit system provides for the region. While benefits from reduced highway maintenance and expansion, land use impacts and traffic congestion are more likely to be realized in larger metropolitan areas, this study nevertheless demonstrates that, even in small urban communities, investment in transit yields significant value to the community. Benefits in Grand Valley are primarily due to decreased gasoline and vehicle maintenance costs, reduced traffic congestion, increased income, avoided public assistance benefits, reduced parking infrastructure demand and reduced cost of medical trips. The basis for key assumptions as well as the calculations for all figures cited below can be found in the Methodology section below.

Fuel Savings
Transit trips on the Grand Valley Transit system reduced vehicle miles traveled (VMT) by 1.6 million miles in 2011. This displaced VMT saved 78,200 gallons of gasoline costing $270,000. Less driving also reduces wear and tear and the need for vehicle repair and maintenance, saving drivers an additional $88,000.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Savings (Thousand $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline Savings</td>
<td>$270</td>
</tr>
<tr>
<td>Vehicle Maintenance Savings</td>
<td>$88</td>
</tr>
<tr>
<td>Reduced Congestion Savings</td>
<td>$551</td>
</tr>
<tr>
<td>Avoided Public Assistance Payments</td>
<td>$208</td>
</tr>
<tr>
<td>Reduced Parking Infrastructure Demand</td>
<td>$622</td>
</tr>
<tr>
<td>Reduced Cost of Medical Trips</td>
<td>$107</td>
</tr>
<tr>
<td>Total Transit Benefit*</td>
<td>$1,845</td>
</tr>
<tr>
<td>Income from Employment Accessible by Transit</td>
<td>$2,125</td>
</tr>
<tr>
<td>Total Transit Benefit with Employment Benefit*</td>
<td>$3,971</td>
</tr>
</tbody>
</table>

*Totals may not match figures due to rounding.
Reduced Traffic Congestion
Use of transit removes vehicles from the road which helps to reduce congestion in the Grand Valley. Without transit service in the region it is estimated that commuters would have spent an additional 32,000 hours delayed by traffic in 2011, which at a value of time of $16.30 per hour means a benefit of $529,000. An additional $22,000 was saved by not wasting gasoline while sitting in traffic.

Access to Work and Other Key Destinations
One of the most important mobility benefits provided by transit is its ability to provide people with access to employment. Onboard surveys indicate that 29% of transit riders use the system to commute to their job. Based on the average household income of transit riders, the total annual wages earned by transit riders would be $21.2 million. If 10% of commuters (118 daily riders) could not get to their job without transit, they would stand to lose $2.1 million in annual wages. Some of these lost wages would be acquired by others filling the jobs and therefore would not be a net loss to the region; therefore the employment benefit is not grouped with the other benefits in Table 5. While there are uncertainties about the scope of this benefit, it is still an important economic benefit that should be represented.

In addition to lost wages, some of the unemployed would likely turn to public assistance to supplement their income. Providing basic assistance to these unemployed workers would cost up to an additional $208,000 in public assistance payments.

Another mobility benefit is the lower cost of using fixed route or paratransit services to make important trips. Trips for medical services (which tend to be less discretionary than other types of trips) make up approximately 8% of the system’s trips. If 11.7% of these medical trips are shifted to taxi service this would cost those riders an additional $107,000.

Reduced Parking Infrastructure Cost
Without transit service to serve downtown Grand Junction, additional parking would be necessary to accommodate the hundreds of additional vehicle trips each day into this area. The annualized cost to build and maintain an additional parking structure in the city to meet this demand would be approximately $622,000.

Distribution of Benefits
It is important to note that the benefits identified accrue not only to transit riders but also to the general public. The benefits of reduced congestion, reduced demand for parking infrastructure and avoided public assistance payments, totaling $1,381,000, are shared by the entire community.

Non-Quantified Benefits
Additional benefits from transit service that have not been quantified in this case study include:

- the value of seniors able to live independently at home rather than moving to assisted living facilities or nursing homes;
- the value of health benefits due to transit riders walking or biking to and from bus stops;
- savings related to accident reduction and safety improvements;
ECONOMIC BENEFITS OF TRANSIT SYSTEMS: COLORADO CASE STUDIES

- increased value of real estate in areas with good transit service; and
- the value of health benefits associated with fewer air pollutants and greenhouse gas emissions reductions.

As methodologies for analyzing these benefits advance and more information is collected, it may become possible to quantify these benefits in future studies.

Local Investment and Net Benefit
Local (as opposed to federal) revenue for the Grand Valley system totaled $1.8 million. $370,000 came from collected fares and $1.5 million came from local taxes. Therefore, the net benefit of the transit system would be just positive ($16,000) if employment benefits were excluded and would reach $2.1 million if employment benefits are included.

Methodology

VMT Reduction
The total Passenger Miles Traveled (PMT) on the transit system was used to determine how much vehicle driving is replaced by transit. Specific information on how transit users would change their travel plans if transit service was discontinued was not available as part of the Grand Valley Transit’s Onboard Survey; therefore national averages have been used. Based on data from Transit Performance Monitoring System (TPMS), the American Public Transportation Association (APTA) developed default mode shift factors to represent how transit users would behave without transit service.

The mode shift factor for “small” agencies (with service populations below 500,000) is 0.34, meaning that every passenger mile of transit travel displaces 0.34 VMT. APTA’s analysis also provided a more detailed breakdown of exactly which mode of transportation (such as car, bike or walking) would be used in the face of discontinued transit service in small agencies as shown in Table 6 below.

<table>
<thead>
<tr>
<th>Mode Choice</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>12.8%</td>
</tr>
<tr>
<td>Walk</td>
<td>26.8%</td>
</tr>
<tr>
<td>Ride with someone</td>
<td>22.8%</td>
</tr>
<tr>
<td>Taxi</td>
<td>11.6%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>4.5%</td>
</tr>
<tr>
<td>Not make trip</td>
<td>21.5%</td>
</tr>
</tbody>
</table>

While the mode shift factor and mode choices may not accurately reflect the reality of the Grand Valley system and its users, it is difficult to make more accurate assumptions without survey data to better understand local behavior.

Based on one PMT on transit replacing 0.34 VMT, the Grand Valley system, which had 4.7 million PMT on transit, replaced 1.6 million VMT. In 2011, the average light duty vehicle had an estimated fuel efficiency of 20.5 miles per gallon, so the reduction of 1.6 million VMT saved 78,240 gallons of gasoline at a cost of $269,927 (based on the 2011 average statewide gasoline price of $3.45 per gallon).

Reduced VMT also reduces vehicle maintenance costs such as the need for routine tune-ups and replacement tires. Costs such as insurance, license and registration fees and depreciation are not considered as they are not as directly affected by reduced mileage. The average per-mile
Reduced Traffic Congestion
The Texas Transportation Institute (TTI) publishes an annual Urban Mobility Report which assesses the impacts of congestion on urban areas across the United States. Although Grand Junction is not included in their assessment, the methodologies from the report can be applied to the region to estimate the value of transit service in reducing congestion. The assumptions made for small urban areas (less than 350,000 residents) are used for this analysis. Based on the metropolitan area around Grand Junction having a population of 120,000 and the ratio of population to commuters being 2.2 to 1 it is estimated that there are 49,303 commuters in Grand Valley service territory. TTI estimates that for small urban areas the annual delay per commuter would increase by 36 minutes a year if transit service was discontinued, resulting in an additional 29,582 hours of delay. The value of time for small urban areas was estimated at $16.30 per hour by TTI (which is on the high end of a reasonable valuation of the cost of time in congestion). When multiplied by the total hours of additional delay, this results in transit’s current value in reducing congestion of $528,649. These savings do not include the additional value of the cost to commercial vehicles (which have much higher time values).

In addition to the travel time savings created by the transit system, there are fuel savings from less time spent in congested traffic. TTI estimates that in small urban areas one transit trip saves 0.006 gallons of gasoline due to reduced congestion. Multiplying the number of trips for Grand Valley (1,045,898) by 0.006 gallons gives a total fuel use reduction of 6,537 gallons for savings of $22,552.

Adjustment of Onboard Survey Origin & Destination Numbers
Grand Valley Transit’s 2011 Onboard Survey asked passengers where they were going to or coming from and included “home” as an origin or destination. To better reflect the purpose of the trips made on the Grand Valley system, “home” responses were taken out of the survey results and the percentages for each category of trip were recalculated using the lower denominator without the “home” origin and destination. Table 7 shows the adjusted percentages of trip purpose.

Table 7 | Trip Purposes of GVT Riders

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Percentage of Total Transit Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>29.3%</td>
</tr>
<tr>
<td>School/College</td>
<td>17.2%</td>
</tr>
<tr>
<td>Visiting someone</td>
<td>7.7%</td>
</tr>
<tr>
<td>Shopping/Errands</td>
<td>14.6%</td>
</tr>
<tr>
<td>Medical</td>
<td>7.7%</td>
</tr>
<tr>
<td>Recreation</td>
<td>3.4%</td>
</tr>
<tr>
<td>Personal business</td>
<td>19.8%</td>
</tr>
</tbody>
</table>

Access to Work and Other Key Destinations
The adjusted percentages above indicate that 29% of transit riders use the service for work commuting purposes. Based on an average daily ridership of 4,028, about 1,180 are work commuters. To determine the average annual household income of all transit riders, the means of the ranges of values given in the Onboard Survey were multiplied by the percentage found in that income range.
resulting in an average annual household income of $18,000. Multiplying the average income by the total number of commuters gives total annual wages for all transit commuters as $21,251,172.

While 89% of transit riders said that they did not have a vehicle available for the trip, it is reasonable to assume that many of them would be able to find a way to continue making the trips they currently make on transit if the service was unavailable. The APTA report cited in Table 6 states that 21.5% of trips currently made on transit would not take place at all without transit service. Assuming that work trips are higher priority than other trips, we estimate that only 10% of work trips on transit would not take place. If these commuters were unable to maintain their employment, they would lose out on $2,125,117 (10% of $21,251,172) in wages.

With less access to employment due to lack of transit, some of these individuals might turn to public assistance to supplement their income. For this analysis, we assume that 25% of these potentially unemployed individuals would rely on public assistance. For families of four (two adults and two children), Mesa County Human Services offers a monthly TANF (Temporary Aid to Needy Families) benefit of $586 (or $7,032 over twelve months). If 25% of the individuals unemployed due to lack of transit received this amount of public assistance over the course of a year, the cost would be $207,553. Thus the total employment benefit of transit would equal the lost wages plus the avoided public assistance payments for a total of $2,332,670.

**Reduced Parking Infrastructure Cost**

Grand Valley Transit’s ability to provide easy access to downtown Grand Junction for employees, shoppers and errand runners significantly reduces parking demand. Based on a daily ridership of 4,028 and the mode shift estimates in Table 6, an estimate can be made of the number of additional parking spaces necessary if transit service ceased to operate. Of current transit users, an estimated 516 would drive alone (4,028*12.8%) and 918 would carpool (4,028*22.8%) in 367 additional vehicles (with an average carpool occupancy of 2.5). Therefore, an additional 883 vehicles would need to park in Grand Junction if there were no transit service. Transit destinations are spread across the city, but are concentrated in the downtown area. It is not possible to determine exactly the proportion of additional demand in this area, but 400 spaces seems a reasonable lower bound estimate for the number of new structured parking spaces necessary.

The estimated construction costs for an aboveground parking structure are $18,000 per space and the annualized cost (including O&M costs of $400 per space per year) would be $1,555 per space, or $622,000 for 400 spaces.

**Less Expensive Trips**

An additional mobility benefit is the low cost service that the Grand Valley system provides compared to a likely alternative for those without access to a vehicle, which would be taxi service. A round trip fare on the Grand Valley system costs $3.00 or $0.33 per mile if the average trip is 4.5 miles in length. To make the same trip in a local taxi service would be significantly more expensive. K2
Taxi Service, for example, charges $4.00 for the first passenger and the first mile of the trip and then $2.50 per mile for each additional mile. To make the same nine-mile round trip by taxi would cost $25.50, or 8.5 times more expensive transit.

Many without access to a vehicle are unlikely to be able to afford to make a significant number of trips using taxis, which would result in a large number of trips that would shift to other modes or be repressed. Medical trips, which can be less discretionary, account for 7.7% of all transit trips, or 40,574 total round trips (81,147 total unlinked trips). While many medical trips would be repressed, shifted to more convenient locations or reached via carpooling or other alternative means, some number of these trips would need to shift to taxi service to take place. Based on the APTA report (as shown in Table 6), 11.6% of medical visits (4,747) would shift to taxi in the absence of transit service. Based on the differential cost of a transit trip and a taxi trip, this would result in medical patients paying an additional $106,810 in transportation costs.

Local Investment
The National Transit Database provides data on the total amount of local (as opposed to federal) funds spent on operating and capital costs, plus the fare revenue collected from customers. Because capital costs can vary significantly each year, a five year average was used. In 2011, Grand Valley collected $368,839 in fare revenues and collected $1,181,015 in local tax funds to support operating expenses. The average (2007-2011) for local funds invested in capital costs was $301,851. This results in a total local investment of about $1,829,700.
IV. CONCLUSION

Although the transit systems in Fort Collins, the Roaring Fork Valley and Mesa County (Grand Junction) serve communities of disparate population sizes, geographic areas and demographics, this analysis shows that each of these transit systems generates millions of dollars in economic benefits for their respective regions. This significant economic benefit to the local community demonstrates that transit service can and should play an important role in creating a strong transportation system outside of the largest metropolitan areas.

Quantifiable benefits range from $3.9 million for Grand Junction, to $5.1 million for Fort Collins and between $52 and $63 million for the Roaring Fork Valley. For Fort Collins, the local investment in transit is $300,000 more than the quantified benefits. The presence of additional non-quantified benefits means that Transfort very likely provides a net benefit to the community. In Grand Junction, the net benefit of the transit system is $2.1 million and for the Roaring Fork Valley the net benefit of RFTA is between $38.6 and $49.9 million.

The greatest benefits from transit in each region are the value of access to employment, reduced demand for parking infrastructure, fuel savings and time savings from reduced congestion. In addition, there are potentially large benefits, such as those associated with increased real estate values due to the access to transit, that we were unable to quantify.

While over half of the benefits identified for each system flow to the actual users of transit, a large share of the benefits accrue to the community as a whole. Transit service provides benefits to everyone in the area and merits public support.
ENDNOTES


10 This was the average for all the small urban areas in the TTI Mobility Report.


12 Personal communication via email with Emma McCardle, Transfort Transit Planner.

13 LSA Associates. 2008. 2008 Transfort Bus Rider Survey. Question 19: Annual Household Income. For the lowest and highest ranges, ‘Less than $7,500’ and ‘$75,000 or more’, the values listed, $7,500 and $75,000 were multiplied by the percentage in the range.


16 The average trip length was determined by dividing the total passenger miles by the number of unlinked trips both of which were obtained from the National Transit Database. National Transit Database. 2012. Transfort. http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2011/agency_profiles/8011.pdf.


18 LSA Associates. 2008. 2008 Transfort Bus Rider Survey. Figure 2. Geocoded Destinations.

19 Personal communication via email with Randy Hensley, City of Fort Collins Parking Services Manager.

20 Ibid.
Assumptions for these calculations come from Victoria Transport Policy Institute. 2012. Parking Costs, Pricing and Revenue Calculator. Retrieved from www.vtpi.org/parking.xls. The basic assumptions are that capital projects would be financed at an interest rate of 2.5% over 20 years which is the average rate of 10 and 30 year municipal bonds listed on Bloomberg.com on March 15, 2013.


The Mode Shift Factor is calculated by adding the percentage of Drive Alone plus the percentage of Taxi, plus the percentage of Ride with Someone divided by 2.5 (the average vehicle occupancy for carpooling).


While the RFTA system does not explicitly calculate this number, RFTA staff suggested that thirteen would be a reasonable estimate of average trip length based on trips in the Aspen region being approximately 11 miles and longer regional trips averaging 16 miles.


RFTA. 2011 Audited Service Contracts. Supplied by RFTA staff.

RFTA. 2012 Passenger Opinion Survey Tables. Table 6-3. Supplied by RFTA staff.

Ibid.

Ibid. Table 6-39.

For the lowest and highest ranges, ‘Under $20,000’ and ‘$90,000+’, the values listed, $20,000 and $90,000 were multiplied by the percentage in the range.


RFTA. 2012 Passenger Opinion Survey Tables. Table 6-6. Supplied by RFTA staff.

Whether or not a several story parking garage in downtown Aspen would be aesthetically acceptable and fit in with the city’s character is an additional challenge to adding large amounts of parking.


Assumptions for these calculations come from Victoria Transport Policy Institute. 2012. Parking Costs, Pricing and Revenue Calculator. Retrieved from www.vtpi.org/parking.xls. The basic assumptions are that capital projects would be financed at an interest rate of 2.5% over 20 years which is the average rate of 10 and 30 year municipal bonds listed on Bloomberg.com on March 15, 2013.
Paratransit system also charges $3 per trip.

59 bonds listed on Bloomberg.com on March 15, 2013. would be financed at an interest rate of 2.5% over 20 years which is the average rate of 10 and 30 year municipal bonds listed on Bloomberg.com on March 15, 2013.

49 Recommended Practice for Quantifying Greenhouse Gas Emissions from Transit. Figure 16.

48 APTA Recommended Practices.pdf.


43 Emissions from Transit. Figure 16.


39 Dial-a-Ride (or demand response) provides service to populations without access to regular transit routes and with prescheduling allows pick-ups and drop-offs at people’s homes.

38 American Public Transportation Association. 2009. Recommended Practice for Quantifying Greenhouse Gas Emissions from Transit. Figure 16.


35 This was the average for all the small urban areas in the TTI Mobility Report.

34 The basic assumptions are that capital projects would be financed at an interest rate of 2.5% over 20 years which is the average rate of 10 and 30 year municipal bonds listed on Bloomberg.com on March 15, 2013.


32 If one removes all the trips that have ‘home’ as an origin or destination one is left with 58% of responses so 58 rather than 100 becomes the denominator when determining trip percentage. For example, work trips made up 17% ((13+21)/2) of total responses but now make up 17/58 or 29.3% of responses.


29 For the lowest and highest ranges, ‘Less than $7,500’ and ‘$75,000 or more’, the values listed, $7,500 and $75,000 were multiplied by the percentage in the range.


27 Assumptions for these calculations come from Victoria Transport Policy Institute. 2012. Parking Costs, Pricing and Revenue Calculator. Retrieved from www.vtpi.org/parking.xls. The basic assumptions are that capital projects would be financed at an interest rate of 2.5% over 20 years which is the average rate of 10 and 30 year municipal bonds listed on Bloomberg.com on March 15, 2013.

The average trip length was determined by dividing the total passenger miles by the number of unlinked trips both of which were obtained from the National Transit Database. National Transit Database. 2012. Mesa County (GVT). http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2011/agency_profiles/8016.pdf.
