Ozarks Transportation Organization
Fixed Route Operations Analysis

April 2012

SRF Consulting Group Team

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Executive Summary

Ozarks Transportation Organization (OTO) conducted a Fixed Route Operations Analysis on the City Utilities (CU) transit system in Springfield, Missouri. The purpose of this analysis is to determine how well current fixed route transit services are meeting local needs and to identify opportunities to improve existing service. OTO also conducted analysis of the potential costs and benefits of implementing regional commuter services from outlying communities to Springfield. The results of that analysis are documented in a separate project report.

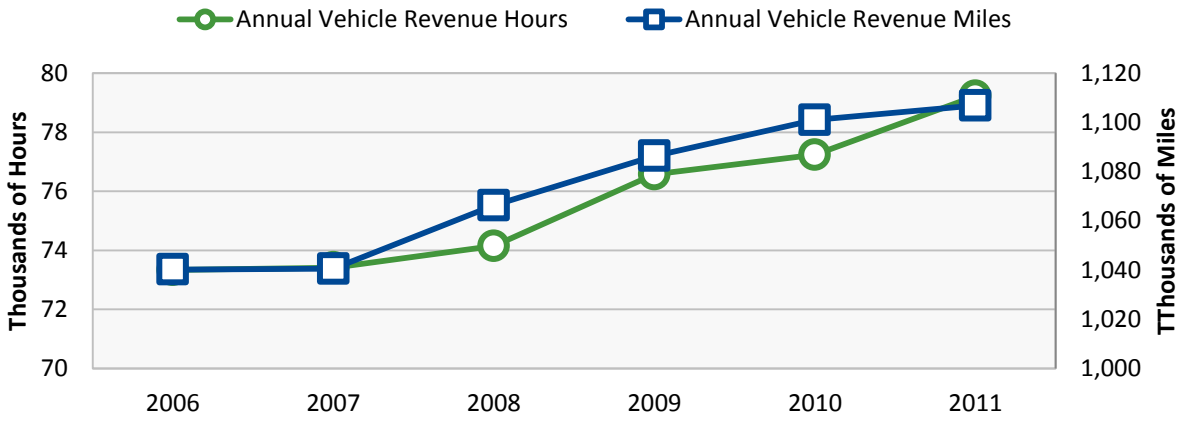
CU is a community-owned utility serving southwest Missouri with electricity, natural gas, water, telecommunications and transit services. CU has operated the public transit system for the City of Springfield since 1945. CU operates 14 fixed day routes and 4 fixed night routes, along with paratransit service (Access Express). Service is provided seven days a week. Daily route service is provided on Monday through Saturday between 6:00 a.m. and 6:35 p.m. Modified route service is provided in the evenings, as well as Sundays and on major holidays. Evening service is provided between 6:00 p.m. and 11:00 p.m., Sunday service is provided between 7:00 a.m. and 11:00 p.m., and holiday service is provided between 8:00 a.m. and 6:00 p.m.

Part I: Existing Conditions

System Overview

In 2011[1], CU's fixed routes provided 79,225 hours of service and 1,106,836 service miles to Springfield area residents. Between 2006 and 2011, service miles increased by 6.4 percent, or an average of 1.3 percent each year; over the same period, service hours increased by 8.0 percent, or an average of 1.6 percent per year.

Figure i: Service Provided, 2006-2011

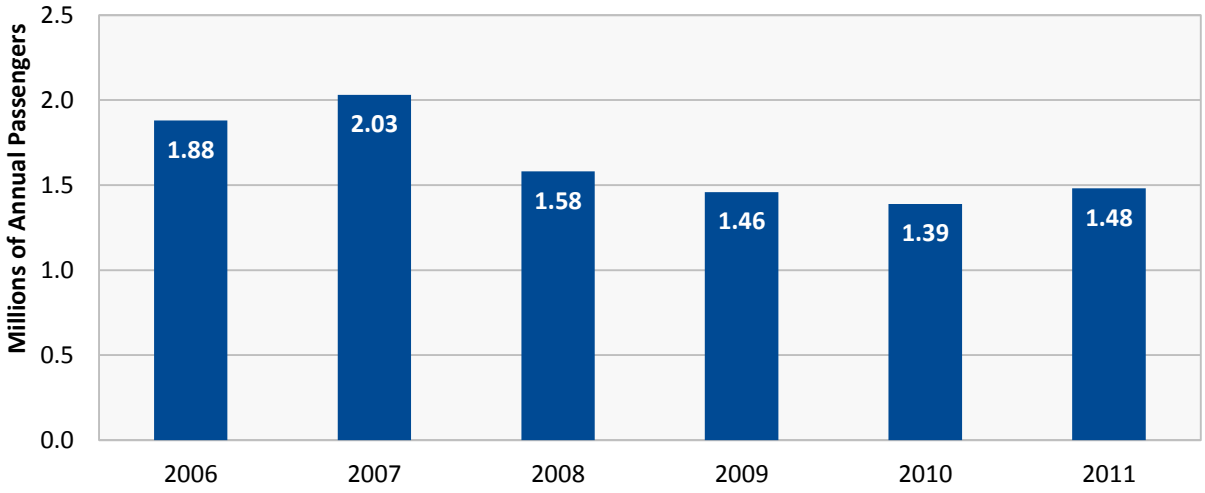


In 2011, CU's fixed routes served 1.48 million passenger trips, an increase in ridership from 2010. Over the period between 2006 and 2011, total fixed route ridership decreased by 15.5 percent. Ridership decreased in 2008, 2009, and 2010. Part of this decrease in ridership can be attributed to fare increases

[1] 2011 Fiscal Year is between October 2010 and September 2011

in these years. Another reason for the decrease in ridership can be attributed to the downturn in the economy.

Figure ii: Annual Fixed Route Passenger Trips, 2006-2011



CU's fully-allocated cost of providing an hour of revenue service was $91.08 in 2011. Total fixed route operating costs were just over $7.2 million in 2011, up 10.3 percent over the previous year. Passenger revenue totaled $931,789 and covered about 13 percent of costs in 2011. The remainder of operations was funded through local ($3.6 million; 50 percent), state (3 percent), and federal (34 percent) assistance.

With a current $1.25 base fare, CU's fare structure is reasonable in relation to the service provided. The national median cash fare in 2008 was $1.35, according to the American Public Transit Association. The daily pass fare is high, but intentionally set at three times the base fare to discourage recreational riding. Generally, a daily pass price should around be two times the base fare when looking to increase ridership. More comprehensive bus systems with later evening service, Sunday service, and more frequent service tend to have higher passenger fares.

CU is fortunate to have a fleet that is predominately low-floor buses, which makes boarding and alighting easy for passengers in wheelchairs as well as ambulatory passengers who have difficulty climbing steps. The bus fleet is in fair condition. The average age of the fixed-route fleet (as of 2011) is 11.8 years, which is older than the national average of 7.5 years. As a result, purchasing new buses should be a high priority for the system.

A review of the 2011 on-board rider survey showed that:

- 22 percent of riders are under 25 years old
- Only 6 percent of riders are 65 or over
- There are slightly more male riders than female (53% male / 47% female)
- Over 60 percent of riders earn less than $15,000 per year
- 29 percent of riders have been riding for less than one year
- 37 percent of riders are travelling to or from work

- 72 percent of riders responded that they were riding because they either don't drive or a car was not available.
- On average, riders responded that 82 percent of their overall transportation needs were being adequately served by current CU fixed route service.
- 87 percent of respondents reported their level of satisfaction with CU Transit as "good" or "very good"

Service Area Overview

An overview of Springfield area residents' characteristics is useful in reviewing the current route structure to identify gaps in service for specific populations or potential explanations for why a service is underperforming. The demographic overview in this analysis examines patterns in:

- **Vehicle availability:** Whether a household has a vehicle available for use is a major factor in determining transit need. The most intense concentration of zero-vehicle households is located in the downtown area, where more than 30 percent of occupied housing units do not have a vehicle available.
- **Low-income population:** Low-income means a person whose median household income is at or below the federally defined poverty thresholds. Within the CU service area, poverty is concentrated around the downtown core, particularly to the north and northwest sides of downtown.
- **English language proficiency:** The Springfield area has a number of Spanish-speaking residents, who represent a growing potential market for transit. Persons with limited English proficiency are also a population to consider in Title VI analyses. Concentrations of limited English proficiency persons are located on the east side of Springfield, near routes 9-S. Fort, 15-E. Kearney and on the west side of Springfield, near Route 6-College.
- **Minority populations:** According to 2010 Census data, 13.2 percent of the population in Springfield is minority. Minority populations are concentrated in large numbers near the downtown core and on the north side of Springfield.

Stakeholder Input

Discussing CU's services with a variety of people in the Springfield area was a key first step in understanding the CU system's strengths and weaknesses and defining potential directions for change. Stakeholder input during the first phase of the study was conducted through several different avenues to gather feedback on current services from a wide range of users, non-users, and others with insight into the transit system.

The following outreach techniques were employed:

- Stakeholder meetings (regional agencies, key employers)
- Public meetings (three meetings across the community)
- On-Board Survey (over 1,800 completed)
- Passenger interviews (multiple routes covered)
- Driver meetings

Generally, CU's services received good marks from stakeholders with current customers giving high levels of satisfaction. Other stakeholders noted that continuing to provide some levels of local transit services is important, especially as more and more people are concerned with the cost of travel.

System Performance Analysis

This section describes the service design evaluation measures used to evaluate the CU system configuration. These measures are based on the University of Southern Florida Center for Urban Transportation Research (CUTR) *Best Practices in Transit Service Planning*.

In addition to the CUTR evaluation measures, a level of service (LOS) assessment was also completed. The LOS assessment can serve as a "report card" to gauge the system's performance relative to a set of national benchmarks. Each quality-of-service factor measured in this analysis is important to CU's operations, as each directly influences how passengers perceive the quality of a transit trip. Levels of service are graded on an A-F scale according to a traveler's point of view, with "A" representing an optimum condition and "F" representing an undesirable condition.

The levels of service and methodologies employed in this analysis are derived from the *Transit Capacity and Quality of Service Manual* (TCQSM), TCRP Report 100. It is important to note that the LOS assessment is not a definitive rating of the system's performance and local decision makers should employ their own locally developed standards to rate service. LOS assessments are often used to measure year-to-year improvements in the service provided. The evaluation measures analyzed and the resulting level of service are summarized in Table i.

Table i: Levels of Service

Performance Measure	Level of Service	Detail
Service Coverage	B/C	79 percent of transit supportive areas covered
Service Frequency	D/E	Most service operates at 30 minute peak, 60 minute daytime frequency
Transit-Auto Travel Time	C	Travel time differential averages between 16 and 30 minutes
Service Span	B	17 hours of service per day is very good
On-Time Performance	B	94 percent of trips on-time is very good

Other measures analyzed include bus stop spacing, number of bus shelters, safety, customer complaints, average fleet age, miles between road calls, spare factor, and service equity for minority and low-income populations. The only area of concern was the average fleet age being higher than desirable.

Peer Group Analysis

The purpose of a peer group analysis is to gain general insights as to the efficiency and effectiveness of a transit system and then to use those insights to guide the more detailed and specific assessment of the system's financial and operating performance. Comparisons of system characteristics and performance are commonplace within peer analysis.

For this analysis, the peer group was selected based on a "likeness factors" as defined by the Florida Transit Information System (FTIS), a data analysis tool that uses National Transit Database (NTD) information. In addition to the peers identified through the FTIS, the City of Tallahassee was also added to the peer group. The peers identified for the analysis are listed in Table ii.

Table ii: Peer Systems

Peer System	Location
Rock Island County Metropolitan Mass Transit District	Moline, IL
Davenport Public Transit	Davenport, IA
Metropolitan Evansville Transit System	Evansville, IN

Peer System	Location
Greater Portland Transit District	Portland, ME
South Bend Public Transportation Corporation	South Bend, IN
City of Jackson Transit System	Jackson, MS
Transfort	Fort Collins, CO
City Transit Management Company, Inc.	Lubbock, TX
Metra Transit System	Columbus, GA
Bloomington-Normal Public Transit System	Bloomington, IL
Fort Wayne Public Transportation Corporation	Fort Wayne, IN
Waco Transit System, Inc	Waco, TX
City of Tallahassee	Tallahassee, FL

Each performance measure was compared to the peer average. The performance measure was considered satisfactory if it fell within one standard deviation of the peer average. The seven performance measures compared to the peers systems and the result of the analysis are as shown in Table iii.

Table iii: Peer System Comparison

Category	Performance Measure	Peer Average	CU Transit
Cost Effectiveness	Operating Expense per Passenger	$4.12	$4.70 ▢
Service Efficiency	Operating Expense per Revenue Hour	$72.00	$89.57 ▼
Service Effectiveness	Passengers per Revenue Hour	19	19 ▢
Market Penetration	Passengers per Capita	13.4	9.4 ▢
	Revenue Hours per Capita	0.7	0.5 ▢
Passenger Revenue Effectiveness	Passenger Revenue per Passenger	$0.64	$0.59 ▢
	Passenger Revenue per Operating Expense	18%	13% ▢

▲ *= Better than peer average*
▢ *= Worse than peer average, but within acceptable range*
▼ *= Worse than peer average and outside of acceptable range*

Part II: Evaluation of Existing System

General System Overview

This part of the report documents system-level observations of operational strengths and deficiencies in the existing City Utilities (CU) transit system. This section also identifies potential route level changes that should be considered to improve overall operations.

The CU transit system in Springfield generally works well. The system operates seven days per week, with a long span of service between 5:45 a.m. and 11:10 p.m. on weekdays, 6:00 a.m. and 11:10 p.m. on Saturdays, and 7:10 a.m. and 11:10 p.m. on Sundays.

The results of the customer on-board survey indicate that in addition to providing many low and moderate income residents access to job opportunities throughout Springfield, the CU transit system also connects people with medical facilities and many social service agencies. Shopping trips are also easily accommodated with the connections between residential locations and commercial areas. Overall, the system is well designed and makes it easy to live in Springfield without an automobile; or, as a family, to have one automobile per household. The system serves areas of the community where there is a large population that is likely to use transit service.

Many minor and some major changes have been made over the years to provide more efficient and effective bus service. The route system is dynamic, with CU management and drivers working to review and improve the system on a regular basis. As route and schedule problems develop, the driver and management cooperation model is able to investigate and solve many service-related problems. In the last three years, there have been 17 route and schedule changes as a result of the close communication between management, drivers, and passengers. CU management also meets with the Missouri Department of Transportation (MoDOT) and the City of Springfield on a regular basis to review transit issues.

Current Network Design Observations

CU operates 14 weekday daytime fixed routes in the Springfield area. All of the routes are designed as typical urban fixed routes; there are no express or limited-stop routes. The system is designed to serve three pulse points:

- The primary pulse point, Park Central Transfer Station, located in downtown Springfield serves 10 routes (1-N. Kansas Expressway, 2-E. Dale, 4-E. Central, 5-S. Glenstone, 6-College, 7-S. Campbell, 9-S. Fort, 12-S. National, 13-Nichols and Broadway, and 14-W. Atlantic).
- A smaller pulse point, located near the Walmart Supercenter (East Kearney Street and North Glenstone) in northeast Springfield, serves as a connection point for four routes (2-E. Dale, 8-Norton, 10-Cedarbrook, and 15-E. Kearney). Only Route 2-E. Dale connects with the downtown pulse point.
- A smaller pulse point located near the Battlefield Mall serves routes 5-S. Glenstone, 11-Sunshine, and 12-S. National. Routes 5-S. Glenstone and 12-S. National also connect to the downtown pulse point.

There are several operating efficiencies that are designed into the individual routes as system policy. Many urban systems have buses pull into individual businesses, such as a Walmart or medical facilities. The CU buses generally remain on the street or at a side passenger loading facility that avoids mixing buses with heavy pedestrian movements. Shelters and turnouts are generally provided at these locations, maximizing passenger safety and convenience.

Network observations and recommendations were provided separately for routes in the northern area of the system and route in the southern area.

North Side Routes

The north side routes, which primarily serve residential areas, are more circuitous with many turns creating long travel times. The three strongest north side routes in terms of total ridership are 1-N. Kansas Expressway, 2-E. Dale, and 14-W. Atlantic. The rest of the north side routes generally have lower ridership and productivity levels.

Strengths

- Good coverage of residential areas
- Safe low-volume streets
- Good sidewalk infrastructure within walking distance to many bus stops
- High transit-dependent population areas served with 30-minute intervals

Weaknesses

- Long travel times on some routes

- Lack of bi-directional travel on many route segments
- 60-minute intervals on several routes
- Complete sidewalk network not in place

Network Recommendations

The recommended changes will result in a more orderly network with some upside growth potential. The current route configuration has very little growth potential. The proposed changes are:

- Combine current Route 4-E. Central and Route 10-Cedarbrook
- Combine current Route 13-Nichols and Broadway with the west half of Route 8-Norton
- Combine current Route 15-E. Kearney with the east half of Route 8-Norton

It is recommended that the services be changed if there is no significant public opposition to the changes, but expectations should be low. There will not be a large increase in ridership. A 10 percent gain in total trips on the modified routes within two years would be considered extremely successful.

South Side Routes

South side routes are linear with relatively fast travel times between points along the route. They are logically aligned along high-travel corridors with the north end of the routes at the Park Central Transfer Station. At the far south end, there is some duplication of routing. Route 11-Sunshine is an anomaly compared to all other routes because it operates in a circular one-way loop. In general, the strengths and weaknesses of the south side routes are described in the following sections.

Strengths

- Relatively fast travel times
- Aligned along high-volume travel corridors
- High job opportunity volume near routes
- Good shelter/bench density

Weaknesses

- Areas with weak sidewalk infrastructure on far south end
- Long pedestrian distances from south side residences to bus stops
- Some turnouts delay bus return to traffic flow
- Dangerous pedestrian crossings on five-lane high-capacity streets

Service reliability and schedule adherence is a problem in the afternoon schedules. Morning trips generally run close to schedule, but as traffic volumes increase, the afternoon buses are often late. Additional resources are needed to improve schedule adherence. There are no “no cost” options available to solve the reliability issues with south side routes.

Bus Stops, Shelters, Benches, Delays

There are 877 bus stops in the CU system, the majority of which are marked. Bus turnouts with benches and shelters are provided at a high number of locations compared to many other transit systems; however, some benches are in poor condition with damaged seats. A good sidewalk network throughout a large portion of the system provides access to bus stops for pedestrians and passengers in wheelchairs.

Springfield has a large number of shelters that appear to have average maintenance. There are 88 shelters in the system, approximately 10 percent of all stops and averaging approximately one shelter every two miles. While there are no national standards for shelter placement, the number of shelters in the CU transit system is high compared to other systems.

Drivers have identified several locations where buses are trapped in traffic backups due to long cycle times at traffic lights. It appears that many signalized intersections have very long cycle times for turning traffic. In general, stops should be moved to the far-side of the intersection at these locations; however, careful traffic engineering studies are needed to determine the safest movement for the bus. The Driver Fixed Route Committee should discuss these locations

Recommendations:

- Bus stop spacing on some routes exceeds generally accepted guidelines so there should be no widening of bus stop spacing to improve on-time schedule reliability
- There are a number of bus stops not optimally located to service customers and some problematic bus stop locations should be moved to far side stops
- Drivers identified a number of locations where buses get trapped by adjoining traffic and further study is needed at some locations to determine the best solution to delays for buses returning to traffic from bus cutouts
- The bench and shelter maintenance program should be reviewed as the system should be more proactive to enhance the overall image of CU Transit

Transfers

According to the on-board survey, about 60 percent of current customers transfer between routes to complete their bus trips in Springfield. The level of transfers between areas of the CU Transit fixed route system varies as shown in Table iv.

Table iv: System-wide Transfers

Transfer Direction	Count	% of Total
North-South	1,525	36.3%
North-North	628	15.0%
South-South	841	20.0%
West-North/South	866	20.6%
Same Route	337	8.0%
Total	**4,197**	**100%**

Recommendations:

It is recommended that transfer activity be periodically monitored to better understand the travel patterns of transit customers. If routes are paired to allow run through scheduling where a north side route is paired with a south side route, then periodic transfer analysis will determine the best route pair combinations.

Vehicles

The current 30-foot bus fleet has been adequate, but the 30-foot bus is not a good bus for future growth. Several trips were observed with standees. The one-door configuration of the current fleet is inefficient at locations, such as Park Central, where there are passengers exiting and boarding simultaneously.

Recommendations:

The purchase of new buses should be a very high priority. The current fleet has an average age of 11.8 years and 23 of the 25 buses will be past their design life in 2012. A grant has been recently received for $3,000,000 from FTA to replace the oldest buses.

Marketing and Media

Marketing of CU Transit service is done by the CU marketing department, which provides marketing for other CU business units as well as transit. The new paratransit buses and bus stop signs have an attractive paint scheme that will enhance the brand image. However, if CU is to expand into different demographic markets from its current ridership base, it will need to make improvements to its current print and electronic media.

The print media used by CU is weak and difficult to use for potential customers. Different formats have been tried in the last decade, and the current presentation of route map and individual schedules is not very effective in explaining the service to new customers. While the trip planner portion of the website is easy to use, it is difficult for a potential customer who uses print media to know their exact location in town and proximity to the nearest bus route.

CU has a reasonably sophisticated electronic media package. A Google Maps based origin-destination website allows passengers to enter their trip ends and the system will determine the best route and provide schedule arrival times. However, using the website to check several origin-destination pairs shows that there are some portions of the route network where Google does not recognize any bus stops.

Recommendations:

Potential new customers will assume that there is no bus service in the area if they use the current CU website. The Google database should be updated.

Future Markets

According to the on-board survey results, CU provides important access for low- and moderate-income people who are traveling to work, shopping, medical appointments, and social activities. With its extensive span of service, good area coverage, reasonably competitive travel times in South Springfield, and good service delivery, CU has some untapped market potential. TCRP Report #28, Transit Markets of the Future, identified several market segments that are most likely to use transit service.

There are three primary target markets that could generate significant ridership increases:

- Workers
- Population aged 65 and over
- College Students

The target market that has the greatest upside potential is college students. An Unlimited Access program designed for each higher education institution, combined with service improvements, can develop the student transit market. Funding for the program can be a partnership between CU and each institution.

Suburban Service

The initiation of transit service to the nearby communities surrounding Springfield should begin with an aggressive carpool/vanpool program. Ideally commuter matching would group people in one town with an employer in Springfield. Best practices for carpool/vanpool include incentives for the driver; reasonable pricing for the passengers; a conflict resolution process; reasonable and timely equipment replacement; standards for the drivers; a reserve driver; and midday transportation for emergencies.

Vanpool and carpool programs can be used as effective planning tools for fixed routes. They will show where people are willing to use a mode other than their personal auto and will show primary destinations in Springfield as well as desired times for arrival at the start of the work day and departure times at the end of the work day.

Part III: Phasing of Improvements

Presented in this part of the report are five levels of transit investments that would improve bus service in Springfield. Each level is designed to be incrementally added in order for the Transit Department to have adequate time to plan and implement the recommendations.

Level I

Level I improvements focus on improving the reliability of the existing system. They consist of several changes that will require three to four months to implement and include no-cost route combinations, increased cycle times on select routes, and supervisory additions. The Level I service improvements can be summarized as follows:

- No-Cost Route Combinations aimed at strengthening some poor performing routes and expanding connection downtown for some parts of town (4 & 10; 8 & 13; 8 & 15)
- Improved Reliability of Existing Service by lengthening the cycle times on some routes to overcome afternoon traffic conditions
- Additional Garage Supervisor to cover hours of service not currently covered by any supervisors
- Mobile Supervisor to overcome delays caused by transfers
- Technological improvements (AVL, APC, TSP) to provide better customer and planning level information

Level II

Level II investment would provide an increase in overall mobility for CU passengers. By making the improvements in Level I, management would have adequate staff to address the growth challenges that would occur in Level II. More frequent service would have the greatest positive effect on transit mode split in Springfield and potentially result in a significant increase in ridership over a two year growth period.

The investments under Level II include:

- 20 minute peak frequency and 30 minute midday frequency on Routes 1/7, 2/12, 5, 6, and 14

- 30 minute all day frequency all Routes 9 and 4/10
- 30 minute Saturday service from 10:00 a.m. to 6:00 p.m. on Routes 1/7, 2/12, 5, 6, and 14

Level III

The third level of investment would focus primarily on the south side. The improvements in service in the first two levels are proportionally divided between north, south, and west side and are designed to enhance overall mobility as well as provide better connections between work and residences. The third level addresses east-west trips that remain exclusively on the south side.

The current network does not serve east-west travel on the far south side very well. The Level III improvements would meet the needs for exclusive south side travel and provide better service for a variety of trip purposes. Two new routes are added on the south side as part of Level III.

The recommendations for Level III improvements are:

- Operate new Route 11 on Sunshine from Walmart to Ingram Mill weekday daytime at 30 minute intervals
- Operate new Route 16 on Battlefield from Walmart on Sunshine to Ingram. Mill weekday daytime at 30 minute intervals
- Provide one evening/weekend bus to connect Ingram Mill to Battlefield Mall
- Implement new Route 17 Walnut Lawn
- Implement new Route 18 Far South

Level IV

The fourth level of investment would provide additional frequency of service on existing routes and incorporate the implementation of limited stop service on some routes. This would provide additional capacity on the existing routes in response to growing ridership as a result of the route and service improvements in the first three investment levels.

Level IV investments would include:

- Limited Stop/Express versions of Routes 5, 7, 12
- 30 minute weekday frequency on Routes 8/13, 8/15
- 30 minute Sunday frequency on routes 5, 12, 22, 26, 27 from 10:00 a.m. to 6:00 p.m.
- 30 minute evening frequency on routes 5, 12, 22, 26, 27

Level V

The final level of investment would produce a very high quality transit service that would make Springfield a national leader in service for cities of similar size. All routes would operate with 15 minute peak service and 30 minute service in the midday. Gaps in the network would be filled with new routes to result in an approximation of a grid with half mile spacing between routes. The final investments include:

- 15 minute peak, 30 minute midday service on all routes
- 30 minute all day service on Saturday and Sunday
- Two new south side routes

Improvement Summary

The operational and capital costs, fleet requirements, and ridership estimates for the existing baseline service and the five levels of incremental improvement are summarized in Table v.

The initial Level I improvements represent a 10 percent increase in annual operating costs and would likely result in a 2 percent increase in annual ridership. The relatively low proportional increase in ridership compared to the proportional increase in cost is due to the improvements primarily focusing on reliability of service in the form of lengthened cycle times and increased supervisory staff.

The Level II improvements would represent a 34 percent increase over current operating costs, but yield much more significant estimated ridership gains with a projected 13 percent increase over current levels. If customers respond favorably to the increased frequency of service, ridership could grow quickly over these estimated levels.

Level III improvements continue to improve the amount of projected ridership gains relative to the operating cost increase with a 70 percent increase in cost yielding a 33 percent gain in ridership over current levels, assuming the increased frequencies in Level II did not attract a significant number of new trips. If Level II improvements were successful the ridership estimate in Level III would be very conservative.

Level IV improvements as described in this report would provide the greatest proportional increase in ridership relative to the increase in operating costs. At this level, a 106 percent increase in operating cost would yield a projected 62 percent increase in ridership compared to current levels. If customers do respond more favorably to the increased frequency levels, this ridership estimate will be very conservative.

Level V, representing the ultimate improvement to CU Transit's frequency of service, route spacing, and operational reliability, would require an operating cost increase of 204 percent over current levels, but would result in a projected doubling of current ridership. Level IV improvements also present the largest estimated capital cost expenditure for implementation. This high cost is entirely due to the nearly 50 percent increase in fleet size required from Level IV to V. Given the significant increase in frequency and area coverage, this ridership estimate could also be very conservative.

Table v: Incremental Service Improvement Summary Table

	Existing	Level I	Level II	Level III	Level IV	Level V
Peak Buses	20	22	29	37	47	76
Spare Buses	5	5	6	8	10	15
Total Buses	25	27	35	45	57	91
Service Hours	72,644	79,983	97,397	123,722	149,287	220,494
Operational Cost	$6,537,915	$7,198,470	$8,765,685	$11,134,935	$13,435,785	$19,844,460
Capital Cost	-	$920,000	$3,200,000	$2,320,000	$4,800,000	$9,680,000
Annual Ridership	1,480,769	1,505,460	1,676,520	1,969,015	2,391,761	2,963,146

Level of Service Impacts

Coverage: The existing system currently covers 79 percent of the transit supportive areas in the Springfield area, putting it at a Level of Service B/C. Level I and II improvements would have little to no

effect on coverage. Level III improvements would increase the coverage to 82 percent of transit supportive areas in the Springfield area, increasing the Level of Service to B. Level IV would not change the area coverage. Level V would increase the coverage to 86 percent of the transit supportive areas and the Level of Service would remain at B.

Frequency: The majority of service on the existing system operates with a frequency of 30 or 60 minutes, earning a Level of Service D/E. Level I improvement would have no impact on frequency. Level II improvements would increase the average frequency to 20-30 minutes, raising the Level of Service to C/D. Levels III and IV would see no change in this level of service measure. Level V improvements would increase the average frequency to 15-30 minutes. However, this would not be enough to raise the Level of Service grade for frequency.

Travel Time: The existing service currently operates at a Level of Service C for travel time. This equates to a difference between transit and auto travel times for comparable trips of roughly 16-30 minutes. The largest improvement to travel time would be as a result of the implementation of transit signal priority (TSP) in Level I. The implementation of TSP systems has the potential to reduce transit travel times by up to 15 percent. This could potentially raise the Level of Service for travel time to B when limited stop service is implemented under Level IV and to a borderline B/C under the remaining service level scenarios.

Span: The existing system provides an average of 17 hours of service on weekdays, earning a Level of Service B. None of the incremental improvements would have an impact on span of service.

On-Time Performance: The existing service operates at a Level of Service B for on-time performance. As with travel time, the most significant improvements to on-time performance would be as a result of the Level I improvements. This improvement would primarily be the result of TSP, extended cycle times on some routes, and additional supervisory positions and would likely increase the Level of Service to A/B. No other changes in on-time performance would be expected.

Table vi: Level of Service Impacts

LOS Category	Existing	Level I	Level II	Level III	Level IV	Level V
Coverage	B/C	B/C	B/C	B	B	B
Frequency	D/E	D/E	C/D	C/D	C/D	C/D
Travel Time	C	B/C	B/C	B/C	B	B/C
Span	B	B	B	B	B	B
On-Time Performance	B	A/B	A/B	A/B	A/B	A/B

Level A – Best; Level F –Worst

Performance Measures

The performance of CU Transit can be compared to a selection of national peer systems based on a variety of performance measures. The measures gauge how well local transit service performs against the peer averages for the following objectives:

- **Cost Effectiveness:**
  - Operating Expense per Passenger
- **Service Efficiency:**
  - Operating Expense per Service Hour
- **Service Effectiveness:**
  - Passengers per Service Hour
- **Market Penetration:**
  - Passengers per Capita
  - Service Hours per Capita

- **Revenue Effectiveness:**
  - Passenger Revenue per Passenger
  - Passenger Revenue per Operating Expense

Each measure was assigned one of three assessments: 1) Better than average if the measure was above the national peer average, 2) Satisfactory if the measure was worse than the national peer average, but within one standard deviation of the mean, or 3) Unsatisfactory if the measure was worse than the national peer average and not within one standard deviation of the mean.

The changes in each performance measure as a result of the changes in service were evaluated for each Level. Those measures that utilize passenger total should be viewed as extremely conservative estimates as a significant increase in passenger utilization is possible with the frequency changes implemented under Level III. The performance measure values and peer comparisons are summarized in Table vii.

At the existing level of service, the summarized performance measures all fall within the satisfactory range with the exception of operating expense per service hour. All of the measures remain at the existing levels of service for Level I and Level II service changes. At Level III, the service hours per capita measure rises above the peer average. At Level IV, the passengers per capital measure also rises above the peer average. Finally, at Level V, the operating expense per passenger, passengers per service hour, and passenger revenue per operating expense measures fall into the unsatisfactory category while passengers per capital and service hours per capita remain above the peer average.

Table vii: Transit Service Performance Measures and Peer Evaluation

Performance Measure	Existing	Level I	Level II	Level III	Level IV	Level V
Op. Expense per Passenger	$4.70 ☐	$4.78 ☐	$5.23 ☐	$5.66 ☐	$5.62 ☐	$6.70 ▼
Op. Expense per Service Hour	$89.57 ▼	$90.00* ▼	$90.00* ▼	$90.00* ▼	$90.00* ▼	$90.00* ▼
Passengers per Service Hour	19.0 ☐	18.8 ☐	17.2 ☐	15.9 ☐	16.0 ☐	13.4 ▼
Passengers per Capita	9.4 ☐	9.4 ☐	10.5 ☐	12.3 ☐	15.0 ▲	18.6 ▲
Service Hours per Capita	0.5 ☐	0.5 ☐	0.6 ☐	0.8 ▲	0.9 ▲	1.4 ▲
Pass. Rev. per Passenger	$0.59 ☐	$0.59* ☐	$0.59* ☐	$0.59* ☐	$0.59* ☐	$0.59* ☐
Pass. Rev. per Op. Expense	13.0% ☐	12.3% ☐	11.3% ☐	10.4% ☐	10.5% ☐	8.8% ▼

▲ *= Better than peer average*
☐ *= Worse than peer average, but within acceptable range*
▼ *= Worse than peer average and outside of acceptable range*
* *= Assumed Value based on existing conditions*

Ozarks Transportation Organization
Fixed Route Operations Analysis

Part I: Existing Conditions

Introduction

Ozarks Transportation Organization (OTO) conducted a Fixed Route Operations Analysis on the City Utilities (CU) transit system in Springfield, Missouri. The purpose of this analysis was to determine how well current transit services are meeting local needs and to identify opportunities to improve existing service. OTO also conducted analysis of the potential costs and benefits of implementing regional commuter services from outlying communities to Springfield. The results of that analysis are documented in a separate project report.

This part of the report summarizes key information from the Springfield area as well as the CU transit system overview for Phase I and includes the following sections:

- System Overview
- Service Area Overview
- Stakeholder Input
- System Performance Analysis
- Peer Analysis

System Overview

CU is a community-owned utility serving southwest Missouri with electricity, natural gas, water, telecommunications and transit services. CU has operated the public transit system for the City of Springfield since 1945. CU operates 14 fixed day routes and 4 fixed night routes, along with paratransit service (Access Express). Service is provided seven days a week. Daily route service is provided on Monday through Saturday between 6:00 a.m. and 6:35 p.m. Modified route service is provided in the evenings, as well as Sundays and on major holidays. Evening service is provided between 6:00 p.m. and 11:00 p.m., Sunday service is provided between 7:00 a.m. and 11:00 p.m., and holiday service is provided between 8:00 a.m. and 6:00 p.m. Figure shows the CU fixed route weekday network as of May 2011. Figure 2 shows the night and weekend routes.

Figure 1: CU Weekday Routes (May 2011)

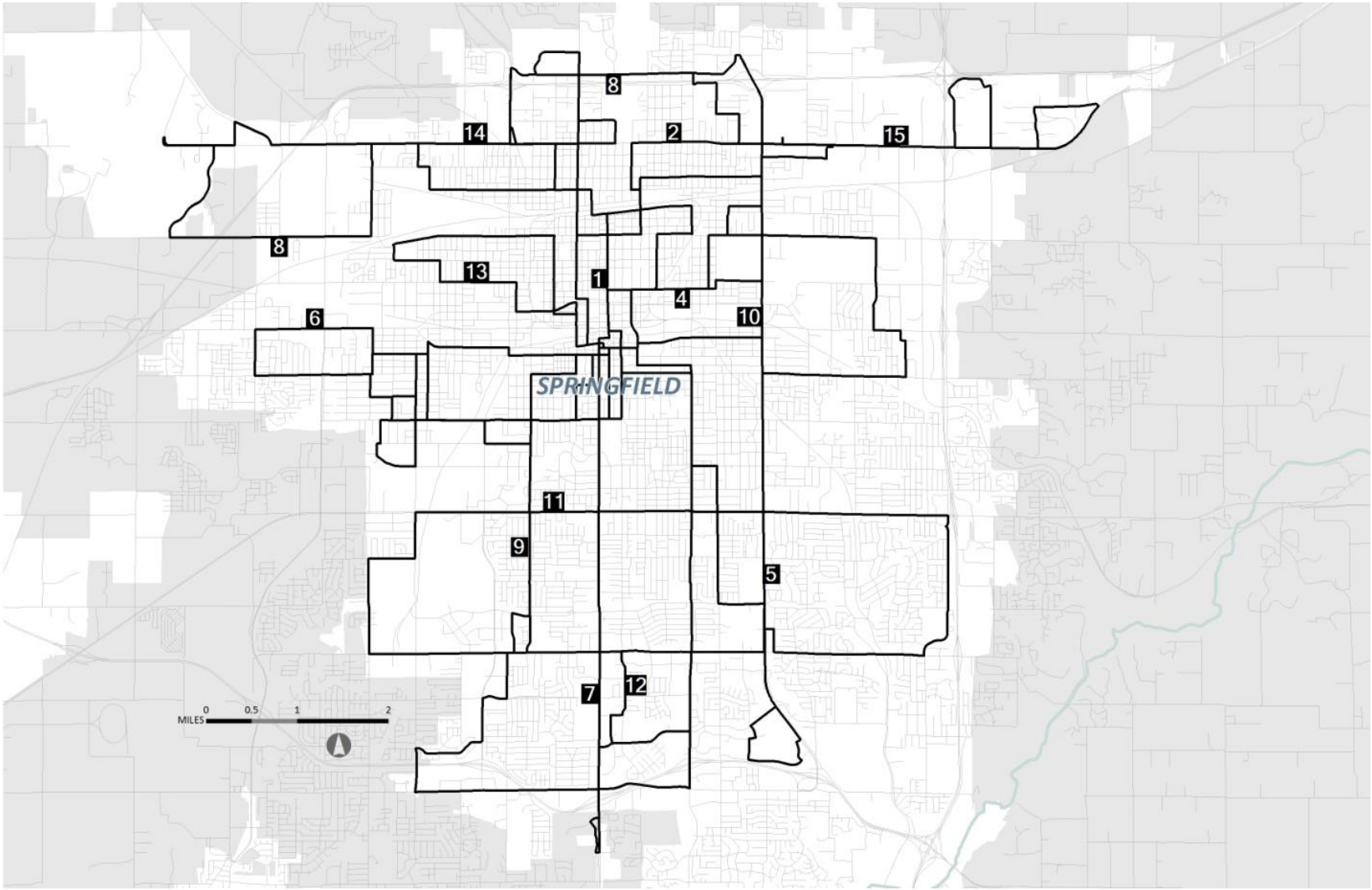
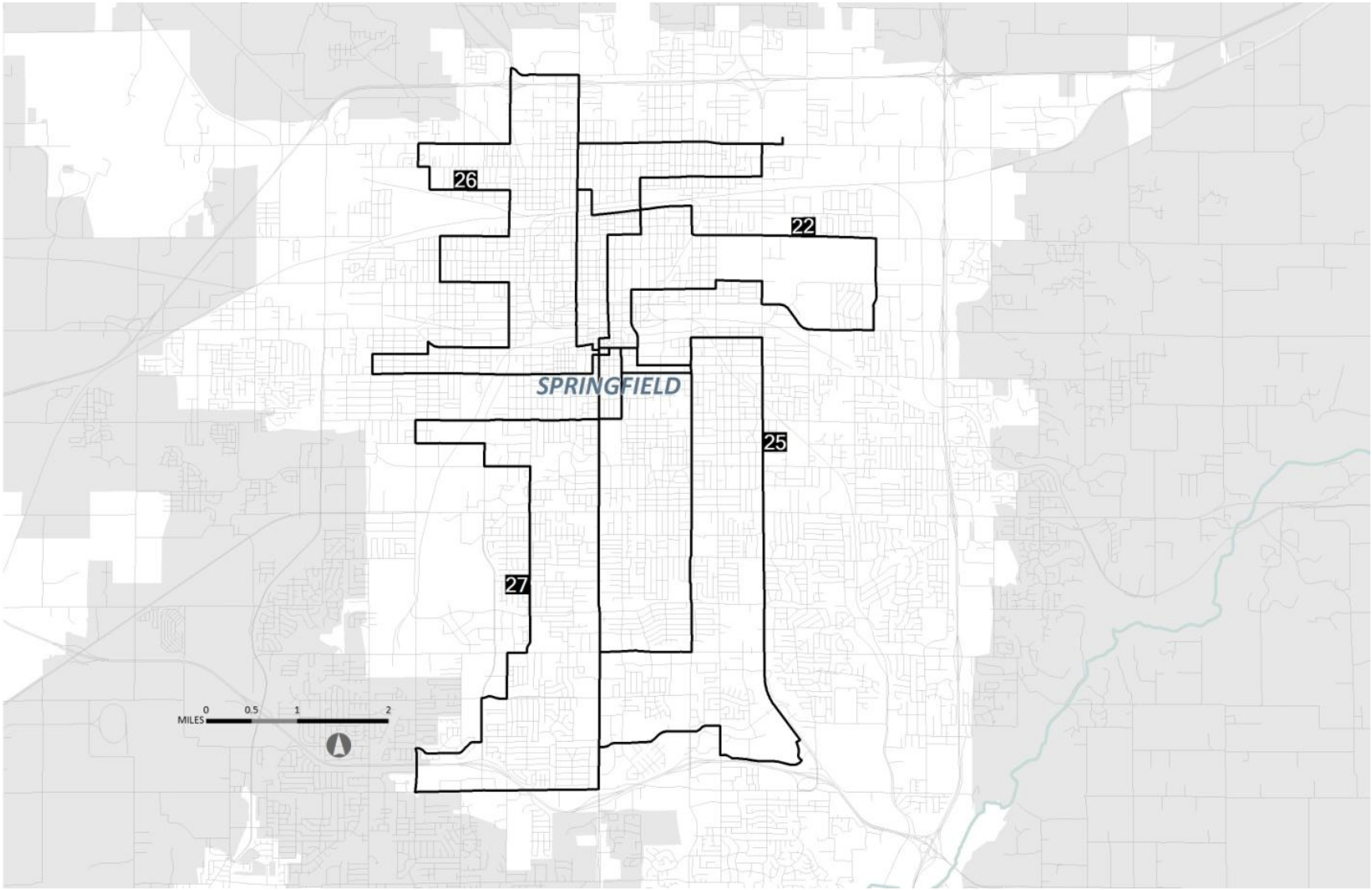


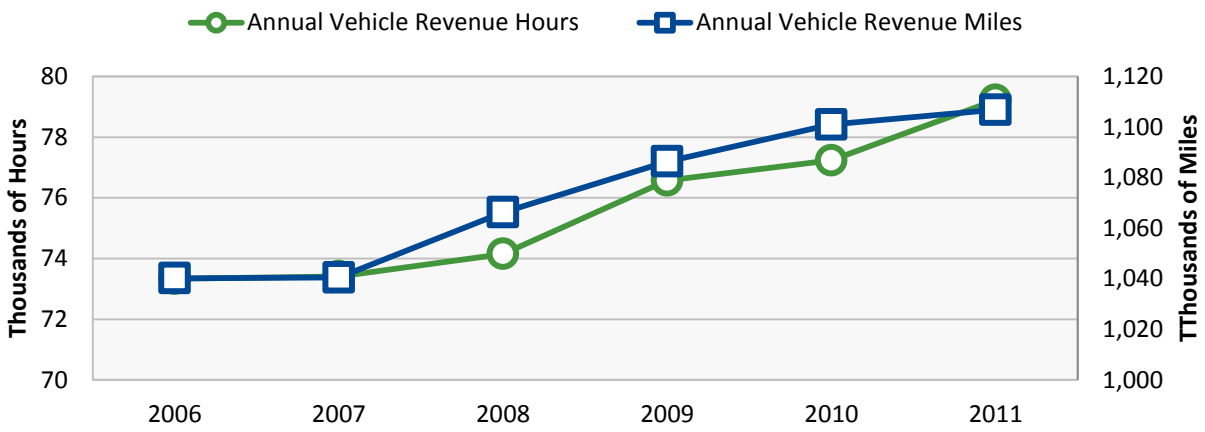
Figure 2: CU Night and Weekend Routes (May 2011)



Service and Ridership

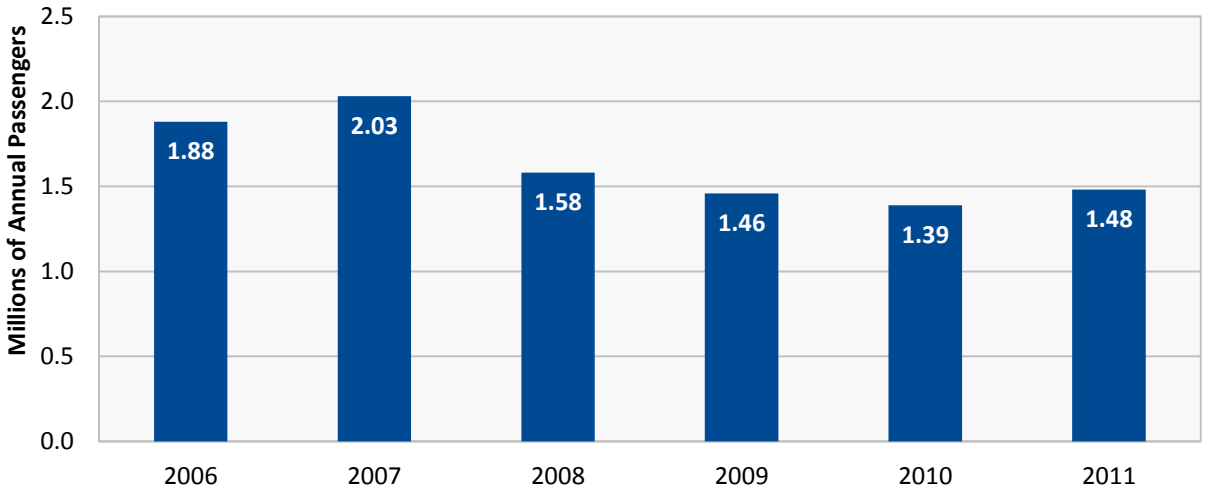
In 2011[2], CU's fixed routes provided 79,225 hours of service and 1,106,836 service miles to Springfield area residents (Figure 3). Between 2006 and 2011, service miles increased by 6.4 percent, or an average of 1.3 percent each year; over the same period, service hours increased by 8.0 percent, or an average of 1.6 percent per year.

Figure 3: Service Provided, 2006-2011



In 2011, CU's fixed routes served 1.48 million passenger trips, an increase in ridership from 2010 as shown in Figure 4. Over the period between 2006 and 2011, total fixed route ridership decreased by 15.5 percent. Ridership decreased in 2008, 2009, and 2010. Part of this decrease in ridership can be attributed to fare increases in these years. These increases are described in more detail in the *Passenger Fares* section. Another reason for the decrease in ridership can be attributed to the downturn in the economy.

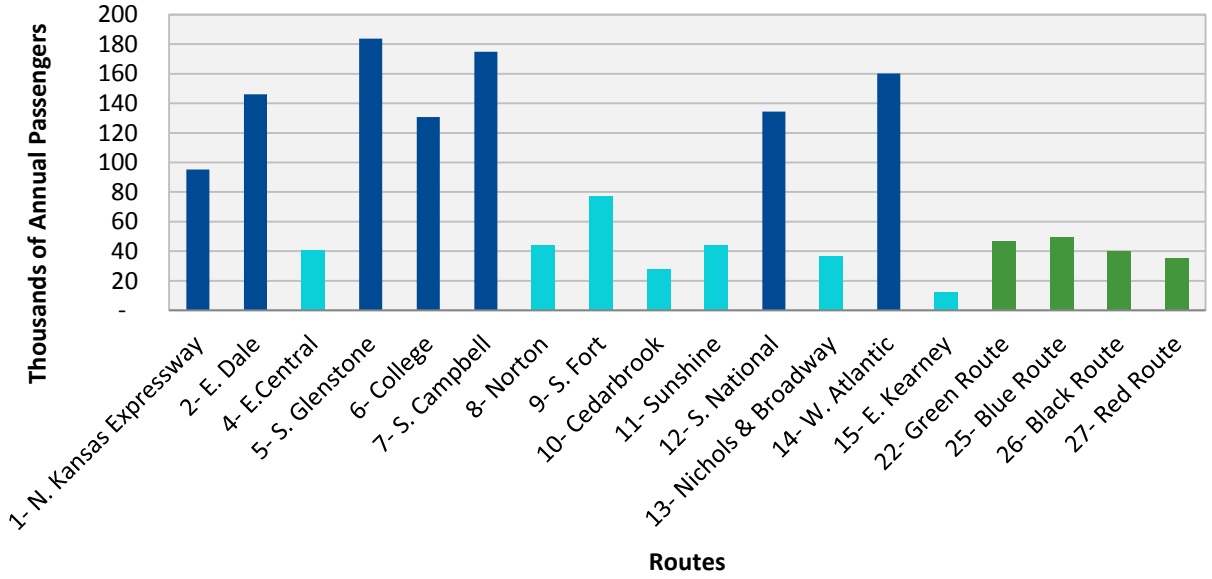
Figure 4: Annual Fixed Route Passenger Trips, 2006–2011



[2] 2011 Fiscal Year is between October 2010 and September 2011

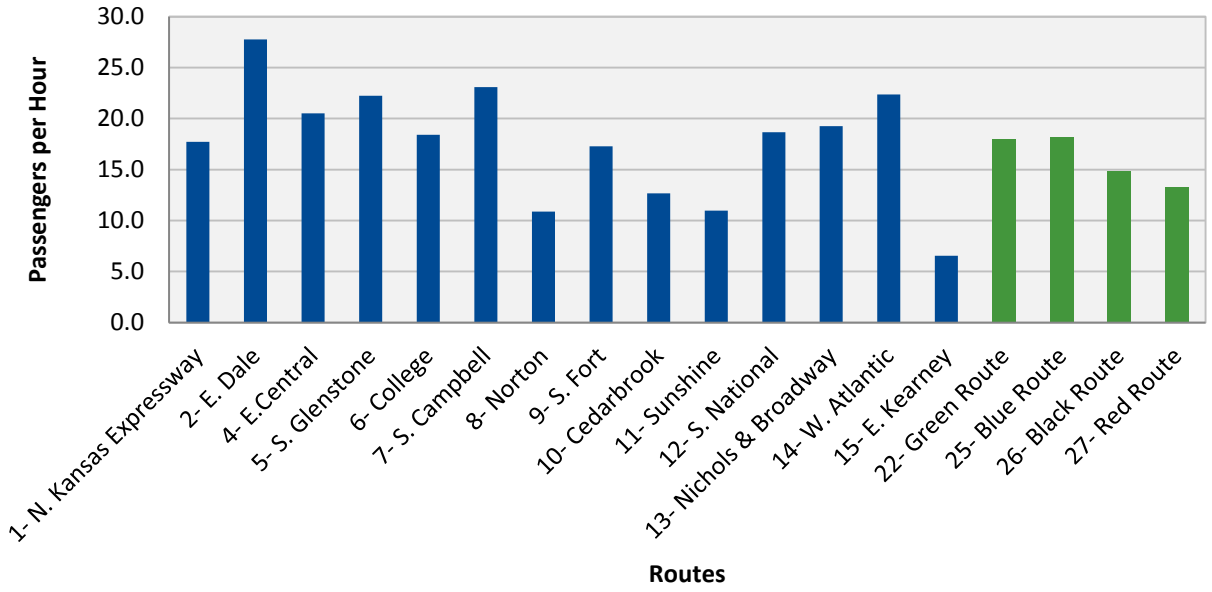
Figure 5 shows the annual passengers by route for fiscal year 2011. Routes 5-S. Glenstone, 7-College, and, 14-W. Atlantic carried the greatest number of passengers, while routes 4-E. Central, 10-Cedarbrook, and 15-E. Kearney carried the least. The weekday routes with a 30-minute frequency are shown in blue, weekday routes with a 60-minute frequency are shown in teal, and night and weekend routes are shown in green.

Figure 5: Passengers by Route, 2011



In terms of productivity, CU carried an average of 18.7 passengers for every hour of fixed-route service provided in 2011. Figure 6 shows the productivity of each CU route in 2011.

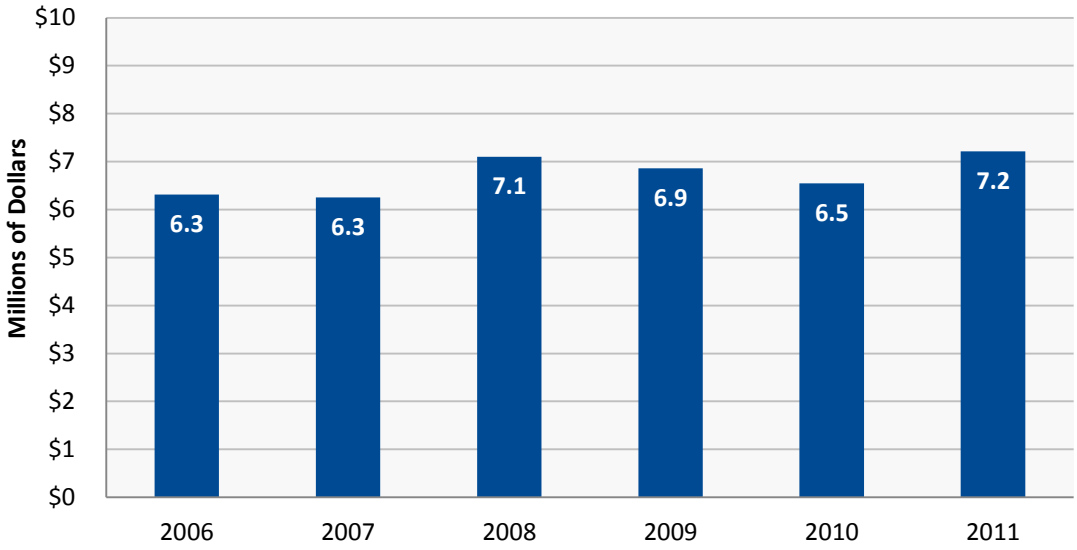
Figure 6: Passengers per Hour by Route, 2011



Operating Costs and Revenues

CU's fully-allocated cost of providing an hour of revenue service was $91.08 in 2011. Total fixed route operating costs were just over $7.2 million in 2011, up 10.3 percent over the previous year (Figure 7). Passenger revenue totaled $931,789 and covered about 13 percent of costs in 2011. The remainder of operations was funded through local ($3.6 million; 50 percent), state (3 percent), and federal (34 percent) assistance.

Figure 7: Fixed Route Operating Expenses, 2006–2011



Passenger Fares

The current fixed route fare structure is shown in Table 2 through Table 4. In 2007, fare increases were approved by the Springfield City Council. Fares increased as shown in the following table.

Table 1: Passenger Fare Increases

Year	Approved Increase	Fare
2007 base fare		$0.75
2007 post fare increase	$0.25	$1.00
2008	$0.10	$1.10
2009	$0.15	$1.25

With a current $1.25 base fare, CU's fare structure is reasonable in relation to the service provided. The national median cash fare in 2008 was $1.35, according to the American Public Transit Association. The daily pass fare is high; generally, a daily pass price should be two times the base fare. More comprehensive bus systems with later evening service, Sunday service, and more frequent service tend to have higher passenger fares.

The fare structure is reasonable for the service level provided. The fare increases in 2007, 2008, and 2009 resulted in a decrease in ridership on several routes where service levels remained constant.

Table 2: Cash Fares by Category

Category	Fare
Adult fare	$1.25
Elderly (65+), Disabled, or Medicare Card Holder	$0.60
Youth (5-18)	$1.00
Transfer	$0.10
Children (under 5)	Free

Table 3: Passes

Pass Category	Fare
Daily Pass (unlimited use)	$3.75
31-day Adult Pass	$45.00
31-day Elderly and Disabled Pass	$22.50
31-day Youth Pass	$30.00
7-day Adult Pass	$13.00
7-day Elderly and Disabled Pass	$6.50
7-day Youth Pass	$10.00
Full Time College Student Semester Pass	$125.00

Table 4: Discount Cards

Category	Fare
Adults (30 rides)	$27.00
Adults (60 rides)	$45.00
Elderly and Disabled (30 rides)	$13.50
Elderly and Disabled (60 rides)	$22.50
Youth (30 rides)	$20.00
Youth (60 rides)	$30.00

Vehicles

CU is fortunate to have a fleet that is predominately low-floor buses, which makes boarding and alighting easy for passengers in wheelchairs as well as ambulatory passengers who have difficulty climbing steps. The bus fleet is in fair condition. The average age of the fixed-route fleet (as of 2011) is 11.8 years, which is older than the national average of 7.5 years.

Table 5: CU Vehicle Inventory

Make	Model Year	Number of Buses	Age
New Flyer	1997	10	14
New Flyer	2000	13	11
Gillig	2005	2	6
Fleet Average Age			**11.8**

Intermodal Connections

Springfield-Branson National Airport

The Springfield-Branson National Airport is the main air facility in Southwest Missouri. It is located in the northwest portion of the City of Springfield, in the central part of Greene County. Four airlines provide service to the Springfield-Branson National Airport with 30 arrivals and departures on a typical weekday. Long-term parking at the airport is $10.00 per day or $50.00 per week.

CU does not currently provide service to the Springfield-Branson National Airport. Airport employees could be potential bus users if transit service was provided.

Intercity Buses

Currently, there is one inter-city passenger bus company, Greyhound, which offers direct bus service to Midwest destinations and connections nationwide. The bus facility is currently served by CU's Route 15-E. Kearney, which runs hourly service on weekdays.

Service Area Overview

This section examines several factors that drive demand for transit service in the Springfield area, including population characteristics, major employer locations, and colleges and universities.

Service Area Population

An overview of Springfield area residents' characteristics is useful in reviewing the current route structure to identify gaps in service for specific populations or potential explanations for why a service is underperforming. For example, low ridership segments often correlate with low population density or high income levels. The demographic overview in this analysis examines patterns in:

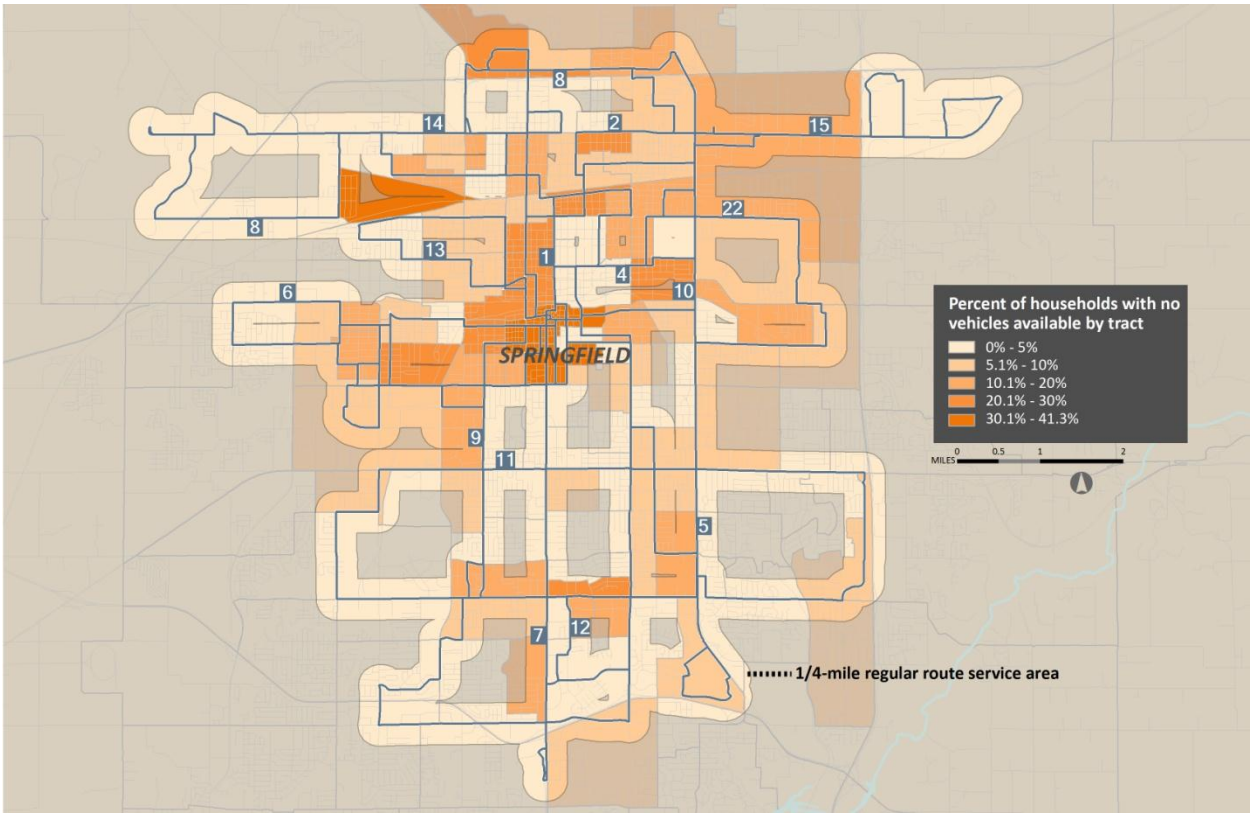
- Vehicle availability
- Low-income population
- English language proficiency
- Minority populations

Later in this section is a brief service equity analysis addressing service frequency and passenger shelters in low-income and minority areas.

Vehicle Availability

Whether a household has a vehicle available for use is a major factor in determining transit need. Figure 8 illustrates the concentrations of zero-vehicle households in the Springfield area. The most intense concentration of zero-vehicle households is located in the downtown area, where more than 30 percent of occupied housing units do not have a vehicle available.

Figure 8: Households with Zero Vehicles Available

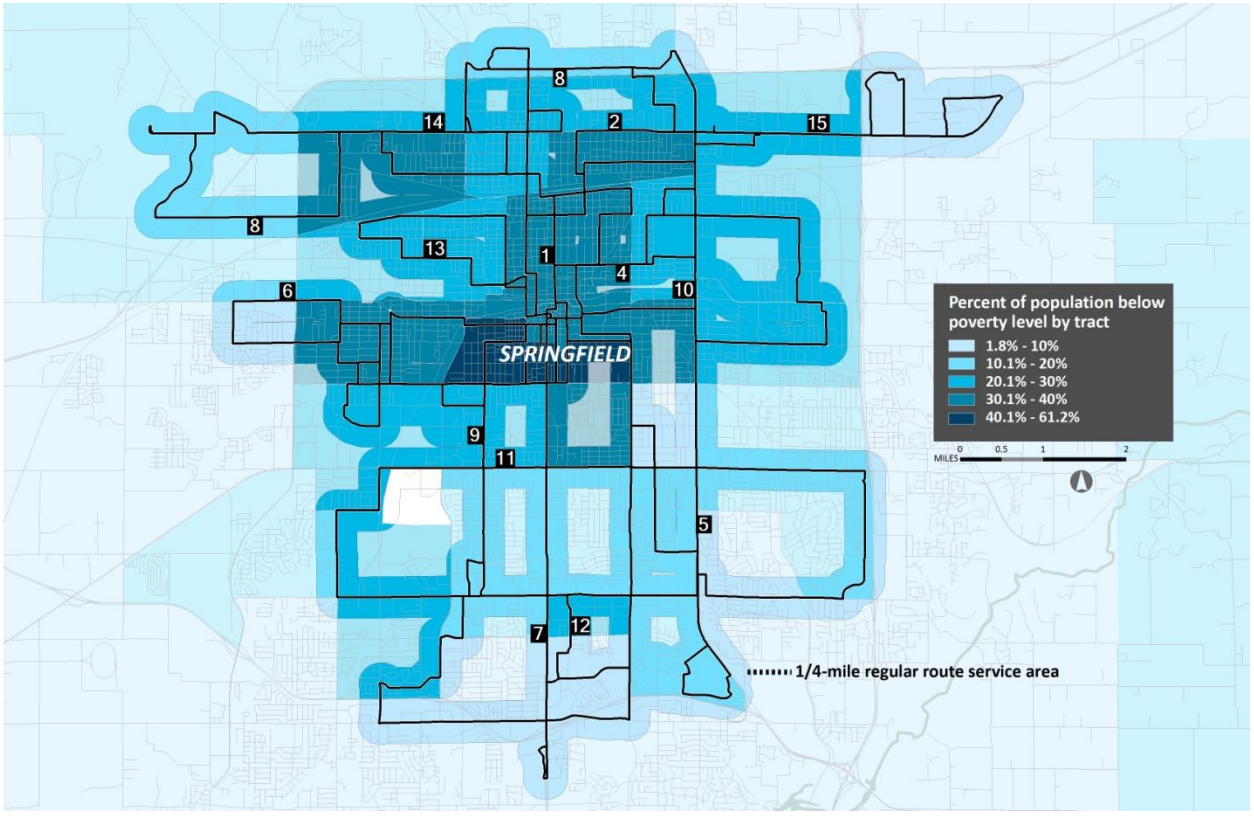


Source: American Community Survey, 2005-2009

Low-Income Population

Low-income means a person whose median household income is at or below the federally defined poverty thresholds. Within the CU service area, poverty is concentrated around the downtown core, particularly to the north and northwest sides of downtown, as illustrated in Figure 9.

Figure 9: Low-Income Population Distribution



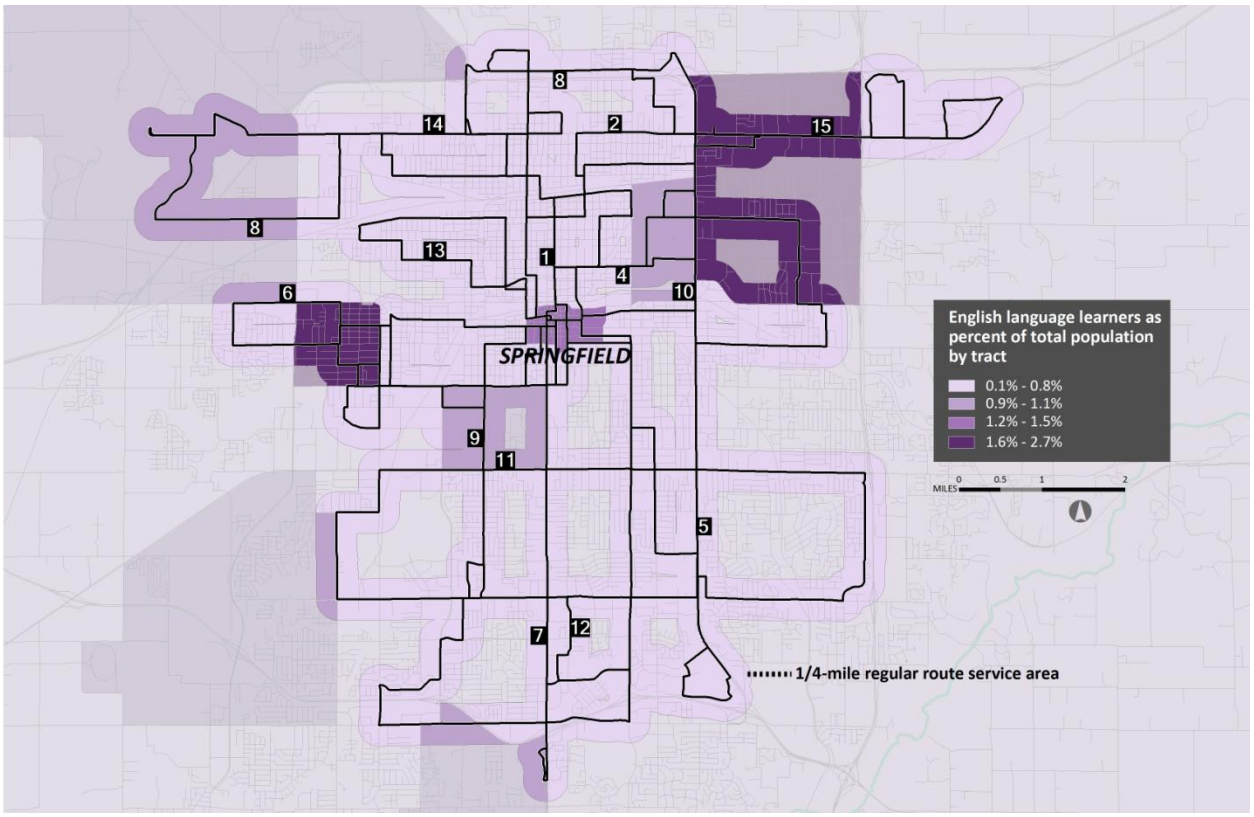
Source: American Community Survey, 2005-2009

English Language Proficiency

A large transit provider like CU must consider who its customer markets are and how they communicate when developing customer information to disseminate with the public. The Springfield area has a number of Spanish-speaking residents, who represent a growing potential market for transit. Persons with limited English proficiency are also a population to consider in Title VI analyses.

Figure 10 represents the percent of the population that speaks a language other than English and understands English less than very well. This analysis defines these persons as the Limited English Proficiency (LEP) population. Concentrations of LEP persons are located on the east side of Springfield, near routes 9-S. Fort, 15-E. Kearney and on the west side of Springfield, near Route 6-College.

Figure 10: Limited English Proficiency (LEP) Population

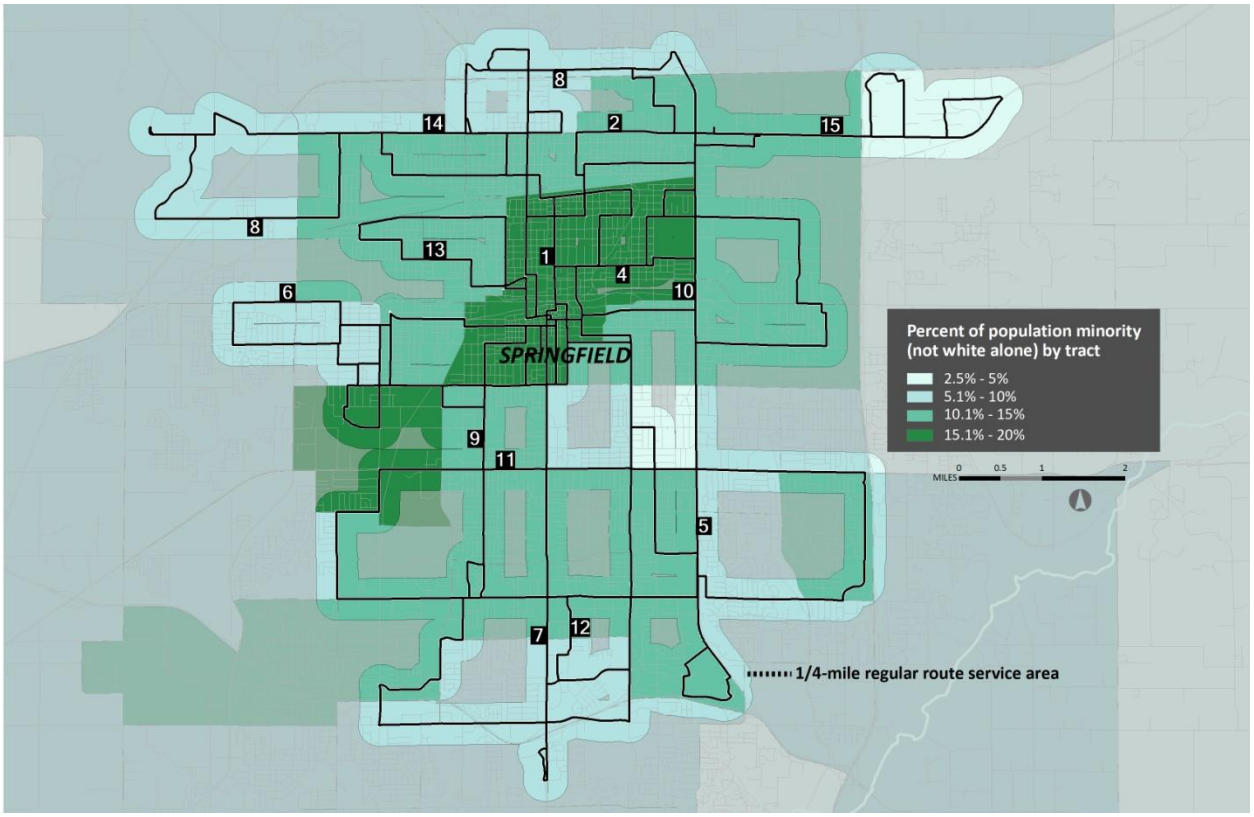


Source: American Community Survey, 2005-2009

Minority Populations

According to 2010 Census data, 13.2 percent of the population in Springfield is minority. Minority populations are concentrated in large numbers near the downtown core and on the north side of Springfield. From a system-wide perspective, CU's multiple routes appear to serve minority populations equitably as shown in Figure 11.

Figure 11: Minority Population

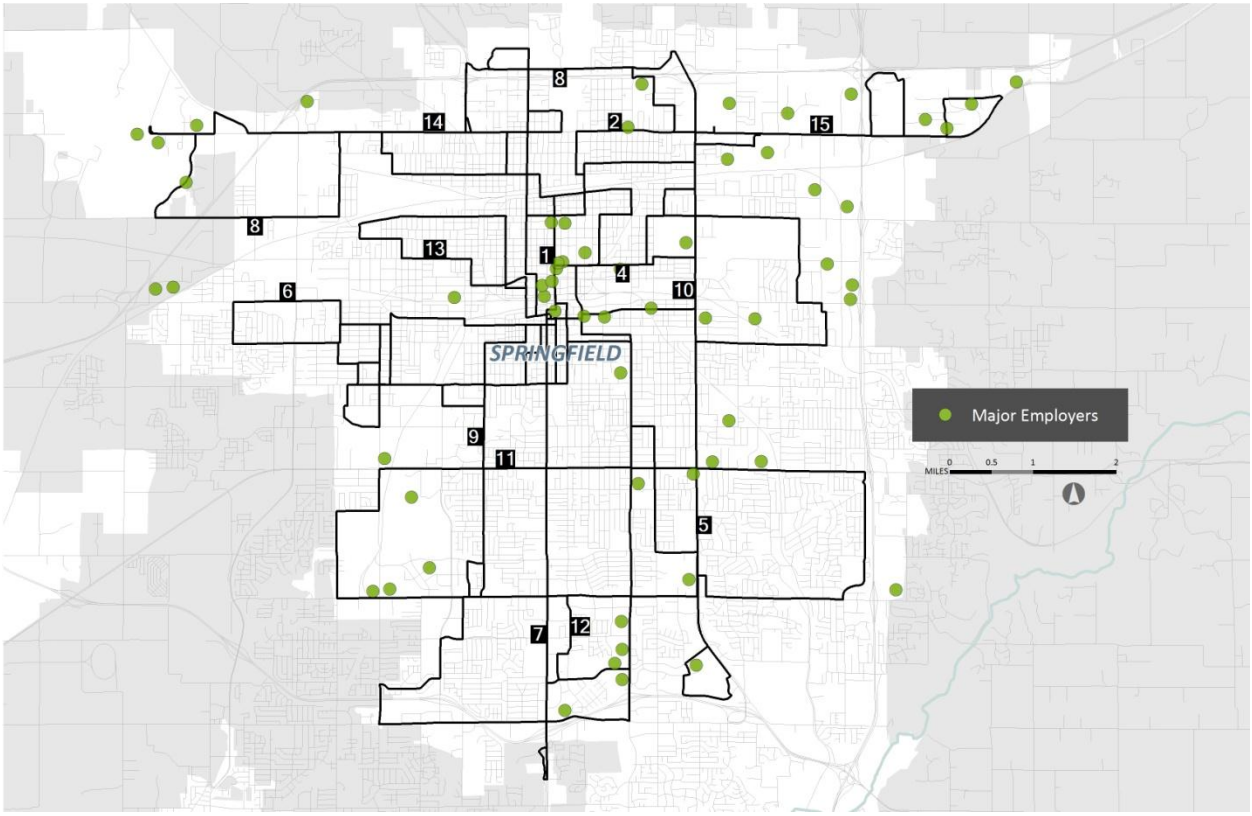


Source: 2010 Census data

Major Employers

Major employers in the Springfield area are mapped in Figure 12 below. Several of the area's large employers are concentrated around downtown, with a secondary concentration of employment on the east side of Springfield. These locations have good geographic access to transit. CU's route network generally serves the major employers in the area.

Figure 12: Location of Major Employers



Source: Ozarks Transportation Organization, August 2011

Colleges and Universities

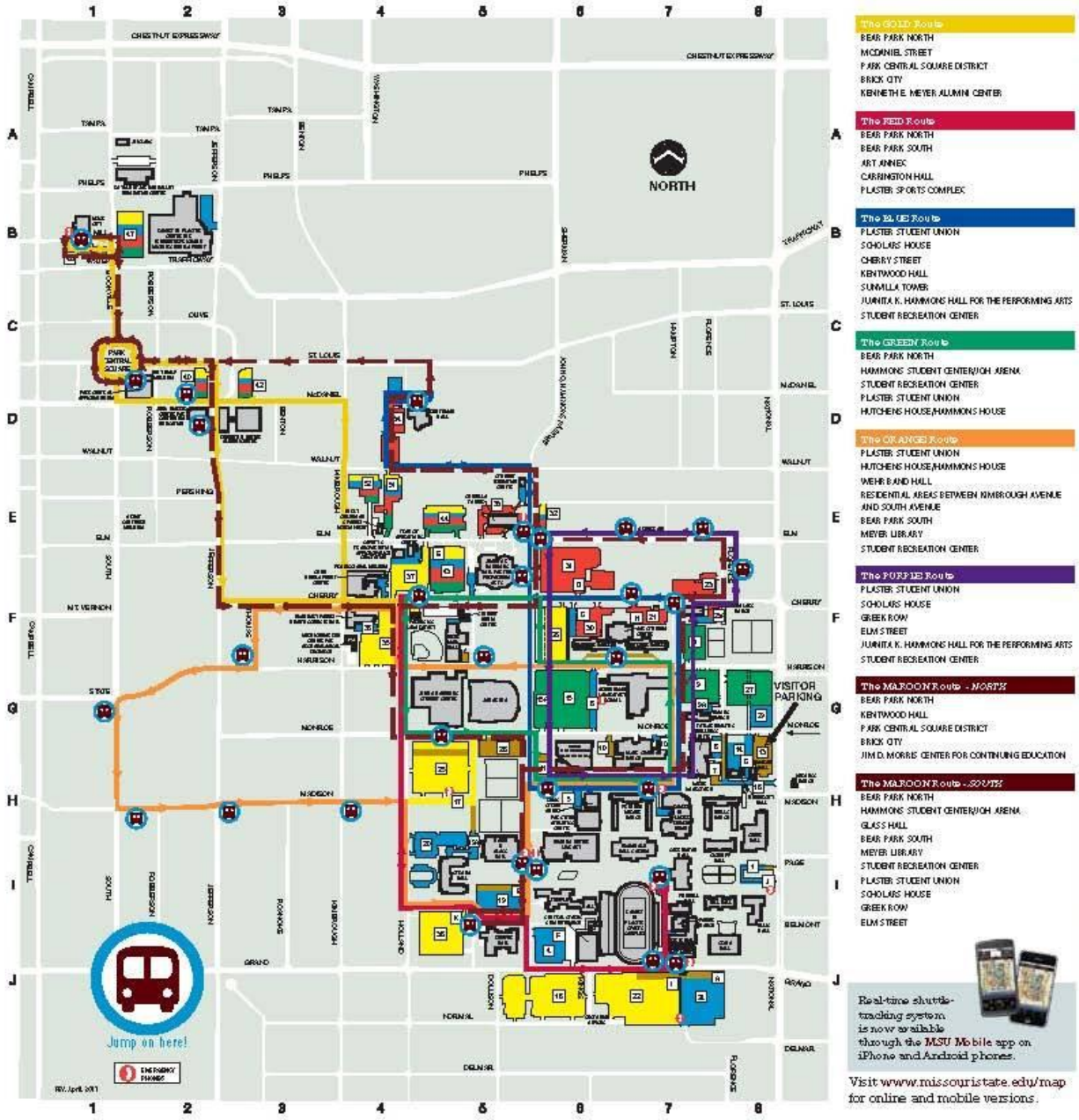
The Springfield area hosts 16 colleges and universities that provide an excellent opportunity for transit service. College-aged students generally have low to moderate incomes, a high level of transportation needs, and a willingness to use whichever mode of travel is most convenient and cost-effective for each individual trip purpose. Frequently, college students have access to an automobile but will use transit service when it is priced advantageously and the service is frequent, fast, and reliable. Colleges and universities are also among the Springfield area's largest employers.

Missouri State University

Missouri State University (MSU) is the largest university in the Springfield area with over 20,000 enrolled students. MSU provides a shuttle service (Bear Line Shuttle) throughout campus as shown in Figure 13. Shuttles operate on weekdays between 7:00 a.m. and 6:00 p.m. An evening shuttle route operates between 6:00 p.m. and 12:30 a.m. Sunday through Wednesday, and between 6:00 p.m. and 2:00 a.m. on Thursday. Shuttles run every 5 to 12 minutes. Shuttle hours vary during the summer semester, holidays, vacation, and periods when classes are not in session.

CU's Route 12-S. National passes thru the MSU campus at the Cherry Street Intermodal Transfer Facility. The Bear Line Shuttle's Gold and Maroon routes connect the campus to downtown near the Park Central Transfer Station. Students can connect to CU service at that location.

Figure 13: MSU Bear Line Shuttle



Ozarks Technical Community College

Ozarks Technical Community College (OTC) is the second largest college in the Springfield area with over 15,000 enrolled students. However, the campus does not have specific transportation services designed to meet student, faculty, and staff needs. CU provides service near the campus via Route 4-E. Central and Route 14-W. Atlantic.

Stakeholder Input

Discussing CU's services with a variety of people in the Springfield area was a key first step in understanding the CU system's strengths and weaknesses and defining potential directions for change. Stakeholder input during the first phase of the study was conducted through several different avenues to gather feedback on current services from a wide range of users, non-users, and others with insight into the transit system.

The following outreach techniques were employed:

- Stakeholder meetings
- Public meetings
- On-Board Survey
- Passenger interviews
- Driver Meetings

The following sections are a summary of the outreach activities that occurred between October 11th and October 13th 2011. Comments from drivers regarding the current route structure and operations are contained in Appendix A.

Stakeholder Meetings

The project team met with various stakeholders including regional stakeholders, the Project Steering Committee, CU transit management and staff, CU's management and Board, Springfield city officials, and Greene County Commissioners and staff. The following sections summarize these meetings.

Regional Stakeholders

Representatives of chambers of commerce and staff from surrounding cities were invited to a breakfast meeting on October 13, 2011 to discuss regional transit service. Fourteen people attended the meeting. Attendees recommended employers in their communities for the project team to contact for data sets to conduct a zip code analysis. Attendees expressed interest in regional transit and said the time was right for planning to begin. In general, the audience appeared to support the following actions:

- Start with carpools or vanpools coupled with park and ride lots.
- Partner with employers to encourage public transit ridership through subsidies.
- Design regional transit to be economically sustainable on its own.

Project Steering Committee

Four members of the Steering Committee met with the project team, CU, and OTO. A presentation was made to explain the study approach and status of activities. The Steering Committee was informed that the project team was seeking data sets from key employers to conduct a zip code analysis of passenger travel patterns.

Springfield City Officials

The project team met with five city officials on October 13, 2011 at City Hall. This meeting included the City Administrator Greg Burris and Interim Mayor Bob Stephens. In the city's 20-year strategic plan, the area of workforce development stressed the need for a high quality bus system. It was emphasized that the system should be on time and operate at a low cost and attract the next generation of riders, such

as college students. City staff noted that Springfield was home to several universities and colleges and had a combined student population of more than 40,000, as many as Ohio State University.

Mr. Burris said the city's population doubles during the day to about 300,000 people, indicating that regional travel was already occurring. He said the community needed to start planning for the future and determine key destinations for regional commuter service.

Interim Mayor Stephens cited factors that impacted ridership, including destinations. "Are we catching the right people, those who need it and those who want it?" He acknowledged the need for sidewalks along some routes. He directed the project team to "find something politically we can sell with CU."

Other areas discussed included:

- Improving travel time;
- Implementing traffic signalization systems that allow bus drivers to control lights as needed;
- Developing a new name for CU transit along with better branding efforts;
- Providing more attractive buses;
- Focusing on the fixed route system and park and ride lots that coordinate with the core service; and
- Conducting an educational campaign that would encourage vehicle owners (95 percent of the Springfield population) to use public transit.

Greene County Commission

The project team met with the three members of the Greene County Commission and two staff members on October 13, 2011 at the Greene County Administrative building. Commissioners questioned the need for regional transportation given the lack of population density in Greene County. A tax to support a Regional Transportation Authority "would not stand a chance in Greene County," one commissioner said. One commissioner cited a recent report that identified priority needs of people who received social services. Next to hunger, transportation was a critical need, particularly for single mothers. "The bus system could work for them, if it didn't take so long," the commissioner said.

The presiding commissioner asked for examples from the private sector to show how a regional approach to transit would work. Commissioners discussed their growth corridor mapping process that called for "activity centers" with urban-styled development close to Springfield; however, transit was not included in this planning effort. They also mentioned was the need to educate the public about the benefits of transit, improve sidewalks and involve employers in meeting transit needs of employees.

Public Meetings

OTO and CU held public meetings to solicit input from the public on the existing transit system and how it could be improved. Public meetings to discuss Springfield's transit needs were held on:

- October 11, 2011 (5-7 p.m.)
- October 12, 2011 (12-2 p.m. and 5-7 p.m.)
- October 13, 2011 (12-2 p.m.)

Time was reserved on the morning of October 12th for people who wanted individual interviews with project staff. In total, 29 people attended the public meetings; 14 self-identified as riders; 13 said they

were non-riders; and two were observers (representatives from Missouri Department of Transportation and OATS).

Most of the public meeting attendees that claimed to be current CU riders were transit dependent. They use the bus to travel to work, shop, houses of worship, as well as many other places. Some attendees had disabilities (blind or low vision, limited mobility), others were seniors, and one identified herself as a college student. None of the participants appeared to have limited English proficiency. Five people asked for individual interviews (in person and by phone) and eight more submitted written comments on comment forms or through email to OTO. Seven members of the Fixed Route Advisory Board attended the roundtable.

Although attendance at the meetings was relatively low, the content of discussions was thoughtful, specific, and well-articulated. Bus riders knew the transit system and understood the connection between expanded service and increased costs. Non-riders generally wanted to know more about the system and how the bus service could meet their needs for transportation and the needs of others who depended on them.

Themes and Findings from Public Comments on CU's Fixed Route Service and Regional Transit

Most people who were current CU passengers generally had positive comments about the CU transit system, particularly about the drivers. Negative comments generally focused on the specific situations of individuals who felt their needs were not being met by the existing operations and service. The following is a summary list of frequent comments.

1. Most riders and non-riders generally wanted more frequent service at night; currently there is reduced night service. Most favored weekday service until at least 7 p.m.; some asked for service until 9 p.m. or 11 p.m. Several people discussed the need to accommodate second shift employees and college students.
2. Riders and non-riders asked for more frequent service during the day and more weekend routes. Additional Sunday service was important to several participants.
3. People at all meetings raised the need for sidewalks up to and at bus stops.
4. Several people suggested having more benches, shelters, and bike racks at bus stops.
5. Riders asked for real-time information in shelters.
6. Attendees commented frequently on the need to improve public perceptions about bus riders. A number of them expressed a desire for greater marketing and outreach about transit in general and about CU and its services specifically.
7. The option of park and ride service received widespread support in the meetings, particularly as it applied to regional service. Some people suggested park and ride lots for buses going to key destinations, such as the airport, shopping malls, and Branson.
8. Express and limited-stop service was a popular concept among attendees and in written comments.
9. The ongoing local issue about a new transfer center came up frequently. Some suggested having more than one transfer station as a way to resolve buses arriving late or leaving early.
10. Riders and non-riders by and large did not voice a clear preference for a grid system over the existing modified spoke and hub system. However, some people suggested a hybrid system that combined elements of both. In an interview, CU Board Member Dan Scott presented a hybrid system that will keep a large percentage of existing stops.

11. People generally supported the idea of regional transit services to outlying communities in Greene and Christian counties. Some suggested adding service to Branson.
12. Attendees agreed that regional service should require a higher fare, but should not be expected to pay the full cost.
13. While many attendees liked the idea of a tax to support a Regional Transit Authority, several people suggested waiting until the economy improved to put a tax increase before voters or to implement one.
14. There was broad support to involve employers in meeting transit needs of their employees. (Support ranged from providing information, waiting areas, carpools and vanpools to offering discounted bus passes, and underwriting bus costs for employees.)
15. Most participants believed more people would ride the bus or consider riding if the price of gasoline climbed to $5/gallon or if people lost access to a personal vehicle.
16. CU met the needs of people who were transit dependent, but did not always meet the needs of people who were senior citizens or disabled; who ride the bus to work; and college and public school students.
17. Some riders said they chose to ride the bus so they could relax on the way to and from work.
18. Advocates for bus connections with the Department of Conservation's Nature Center submitted both oral and written requests for service. (The manager of Park Lane apartments submitted letters requesting a bus stop at or near that complex.)
19. Some participants said CU needed larger buses, particularly on crowded routes.
20. Riders asked that CU communicate with them regularly, through real-time message devices, meetings, newsletters, emails, text messages, or Smartphone apps. They also asked for easier access to information, such as maps that were easier to read and understand and maps that connected with the MSU bus shuttle service.

It should be noted that all of these comments were considered during subsequent review steps, but only those ideas that offer the greatest potential ridership increases were incorporated into the formal recommendations.

Representative comments:

- "The best way to keep people happy is to keep them informed."
- "Correct the local problems first before going out to the suburbs."
- "Have meetings once or twice a year. Be more engaged with the riders."
- "CU Transit is very important to our passengers."
- "It is vital to have transportation available in any city."
- "It doesn't make sense to go downtown to make a five-block ride. "
- "The people who ride the most can't afford a car, so (if fares were increased) they could not afford to ride the bus."
- "When your changes take effect, pick places with sidewalks, but don't disenfranchise areas without sidewalks."
- "If there are enough businesses outside the bus route, ask employers to pay for a shuttle to bring people to and from work."

Key Employer Interviews

This section summarizes the five interviews with human resources executives and directors of some of the key employers in Springfield. The employers were selected based on recommendations and contact

information provided by OTO, recommendations from individuals attending the stakeholder meetings, and research conducted by the project team to identify the largest employers in the city and surrounding suburbs. The interviews were conducted between October 31 and November 14, 2011.

The employers represented health care, public schools, higher education, and manufacturing and distribution. Most were among the top 10 employers in terms of size of work force identified by the Springfield Chamber of Commerce. The general themes from the interviews are summarized in the following section.

Themes and Findings from Employer Interview Comments

The human resources executives and directors interviewed did not have specific information about the means of transportation that their employees used to come to work. Some acknowledged the need to know this information and one planned to include a question about work-related transportation in an organizational survey.

The following are conclusions drawn from the interviews.

1. Students and employees at MSU would welcome better connections between CU transit and the Bear Line (the MSU shuttle). The interviewee suggested that CU talk with Don Clark at MSU about sharing bus stops, integrating maps and other opportunities to foster connectivity.
2. Work transportation does not warrant attention at this time. Employers reported that they do not track:
    a. The number of employees using public transit for work;
    b. How transportation affects those who apply for work; and
    c. How many employees might have more limited transportation options because of income, disabilities, lack of a vehicle or no driver's license.
3. Employers who tracked residency gave a range of 24 to 30 percent of their employees who lived outside the Springfield city limit.
4. Public transit is not part of the community culture. As one interviewee said, "People in the Midwest expect to drive."
5. Springfield has four large hospitals/healthcare employers. There is a vested interest in having a mobile workforce.
6. Human resource problems such as absenteeism and tardiness were seldom related to transportation issues, with the exception of delays caused by accidents or road construction.
7. Gas prices are expected to rise to $5 a gallon and, as a result, there is interest and discussion about public transit, carpools, and vanpools.
8. The cost of work travel is more important than commute times. Congestion in the Springfield area has not risen to the level of inconvenience and is not expected to do so in the near future.
9. Some employees might be interested in park 'n ride and limited stop or express service. The biggest issue would be in timing the service for workers to arrive at least 10 minutes, but no more than 20 minutes early, and to leave within 10-20 minutes after work. Service would also have to meet a variety of work shift needs.
10. Companies would be willing to provide information and maps for CU transit and provide drop off and pick up locations.
11. At least, two employers provided a benefit option that allowed employees to designate pre-tax dollars for transportation expenses. As a result, their businesses would not be likely to underwrite the costs of public transportation for their work force.

12. Interviewees did not know much about carpools or vanpools among their workers, and were uncertain what role their firm would play in coordinating these.

Notable Comments:

- "Students and employees complain about the convenience/location of CU transit routes and stops."
- "More than ever, people are desperate (for work) and more than ever, people are concerned about gas prices."
- "It's a major red flag for me in the interview process if a person lives more than 30 minutes away from work. I have concern about the longevity of that employee."
- "There is not a significant percentage of people who use public transit."

On-Board Survey

Surveys of transit customers, often referred to as on-board surveys, are useful in informing a transit system's planning and operations functions, as well as governmental boards, commissions, and councils. On September 20, 2011, CU conducted an on-board survey. Temporary workers were hired to distribute and collect surveys on all weekday daytime routes.

A total of 1,844 surveys were submitted; fixed route ridership for that day was 5,473. Not all questions in the surveys were answered by the respondents; therefore, results are presented as percent of the total responses for each question. The following section summarizes the results of the on-board survey.

Figure 14: Which route are you on?

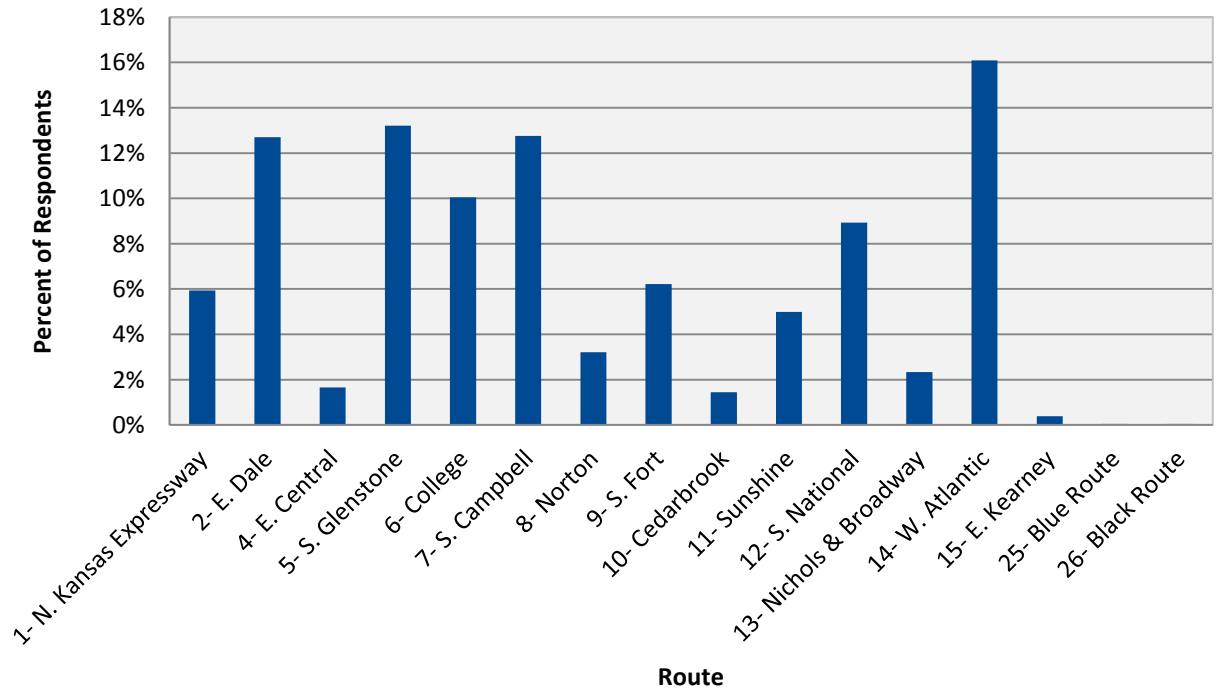


Figure 15: Where are you going to or coming from on this trip (other than home)?

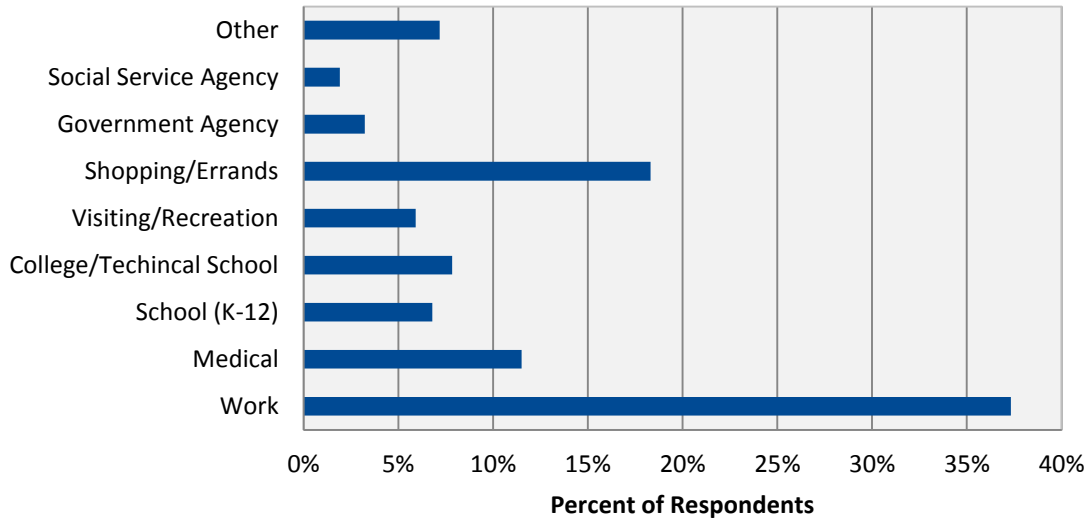


Figure 16: Did you transfer to this route or will you transfer to another route to complete your journey?

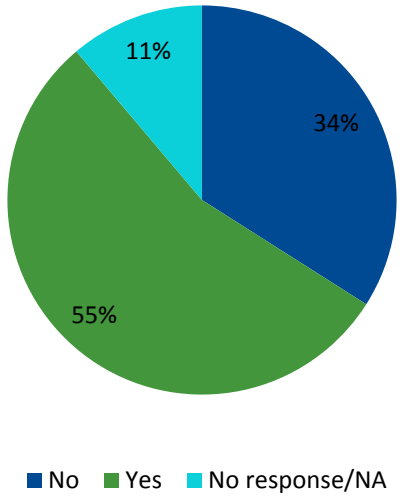


Figure 17: If you transferred or are going to transfer, which route will you transfer to?

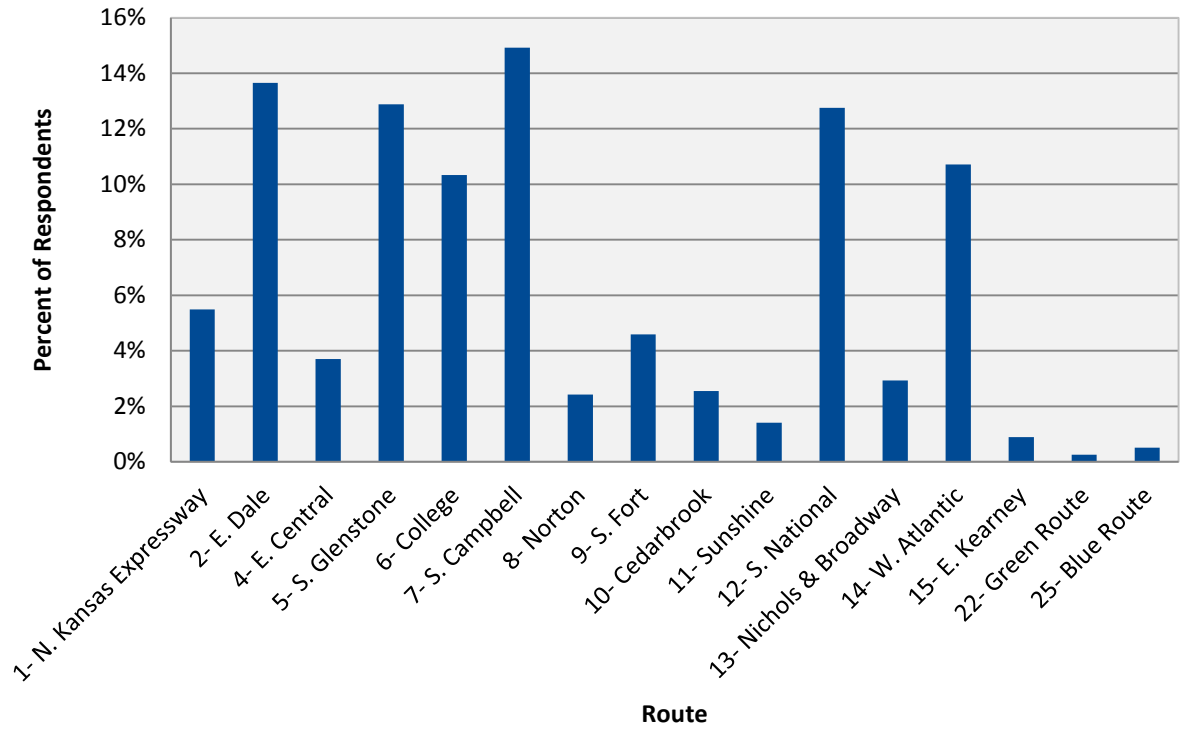


Figure 18: How did you pay for this trip?

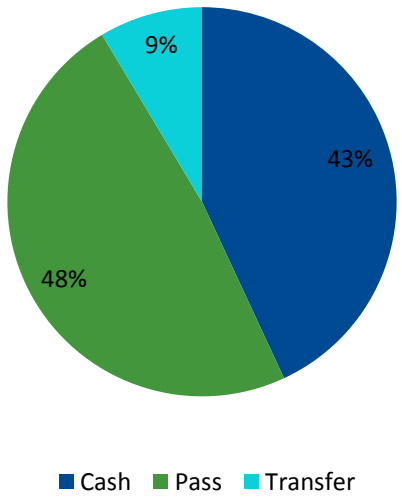


Figure 19: What is the main reason you took the bus today?

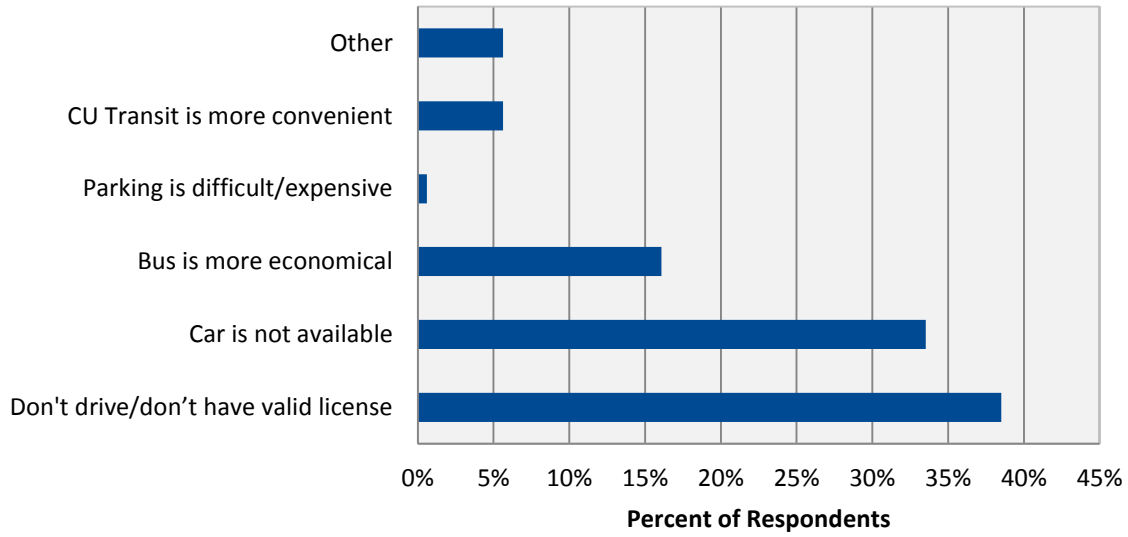


Figure 20: How often do you use CU Transit?

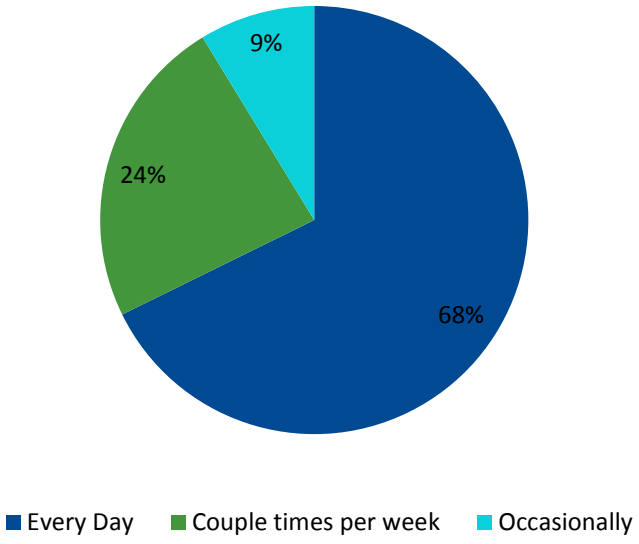


Figure 21: How long have you been a transit user?

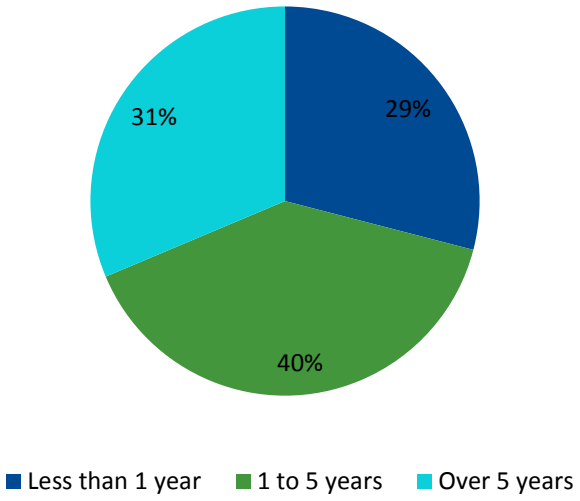


Figure 22: How would you rate your overall satisfaction with CU Transit?

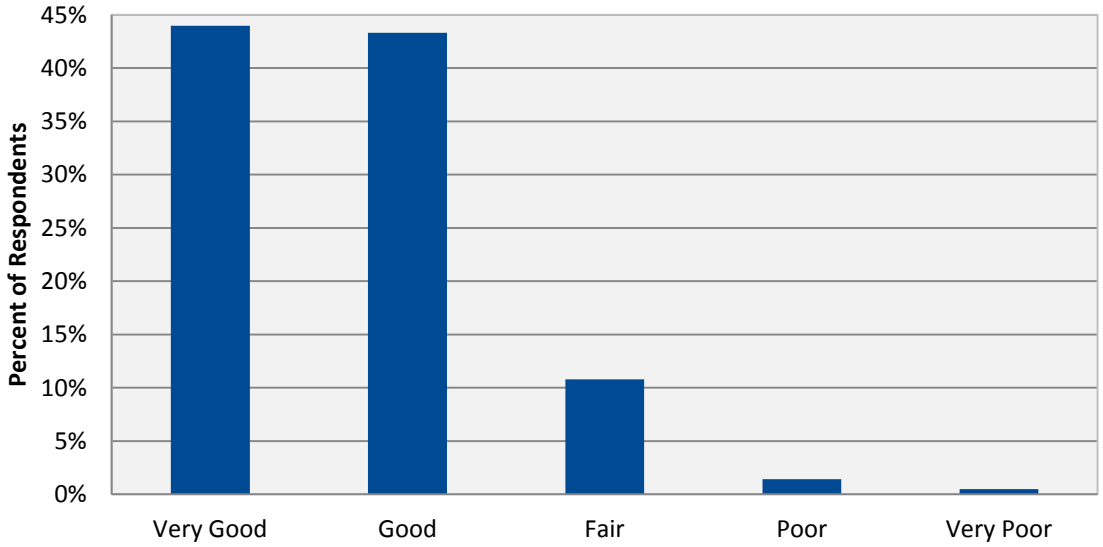


Figure 23: How would you rate your ability to get where you want to go?

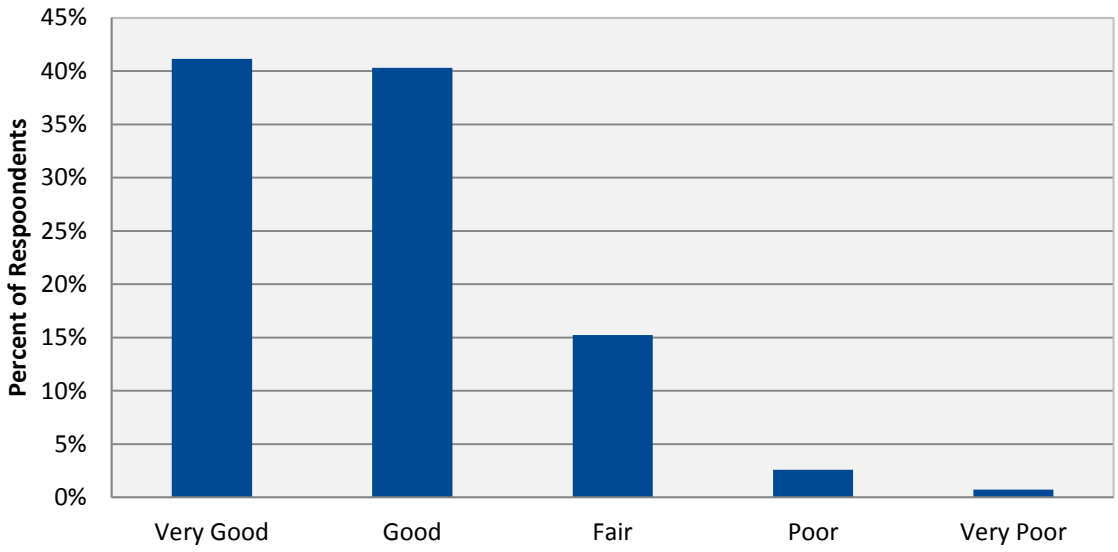


Figure 24: How would you rate the dependability of CU Transit buses (on-time)?

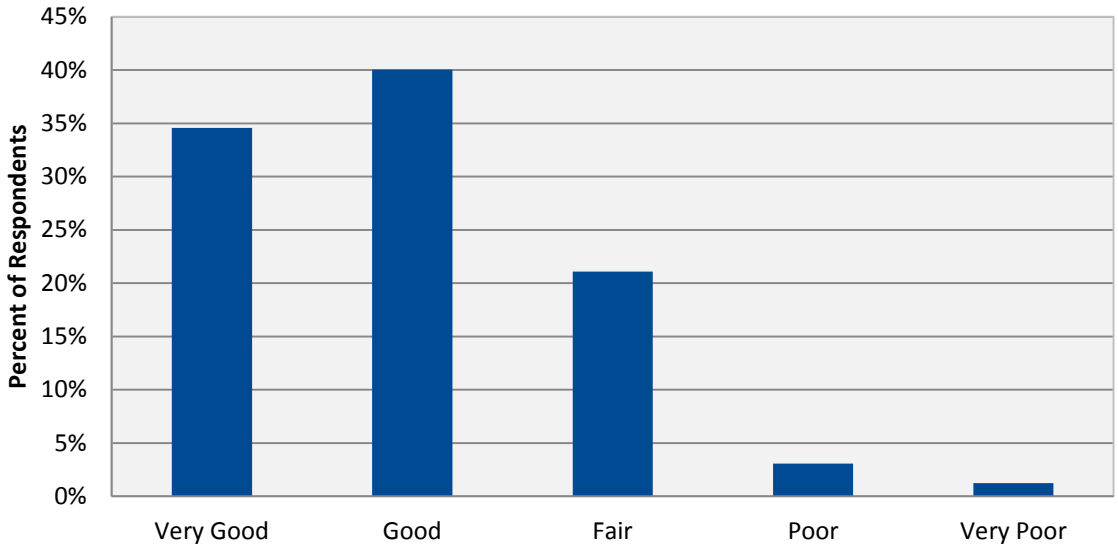


Figure 25: How would you rate the availability of bus route information/maps?

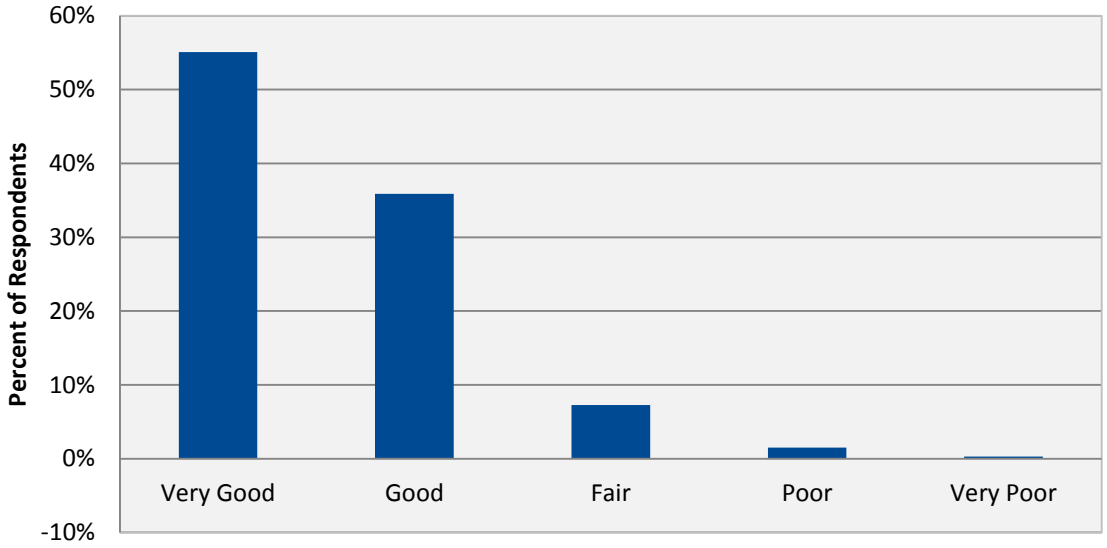


Figure 26: How would you rate the availability of seats on the bus?

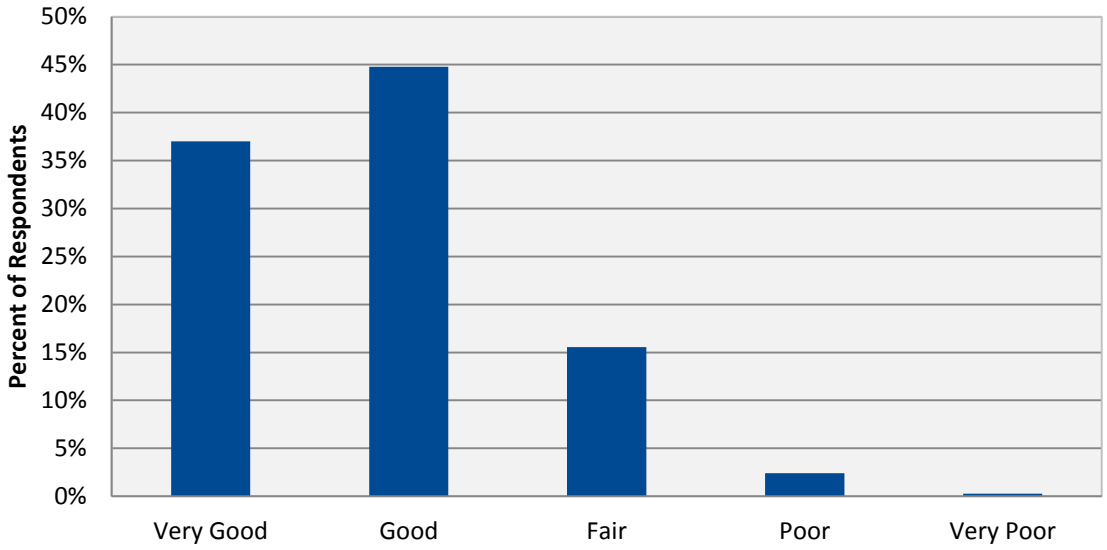


Figure 27: How would you rate safety on the bus?

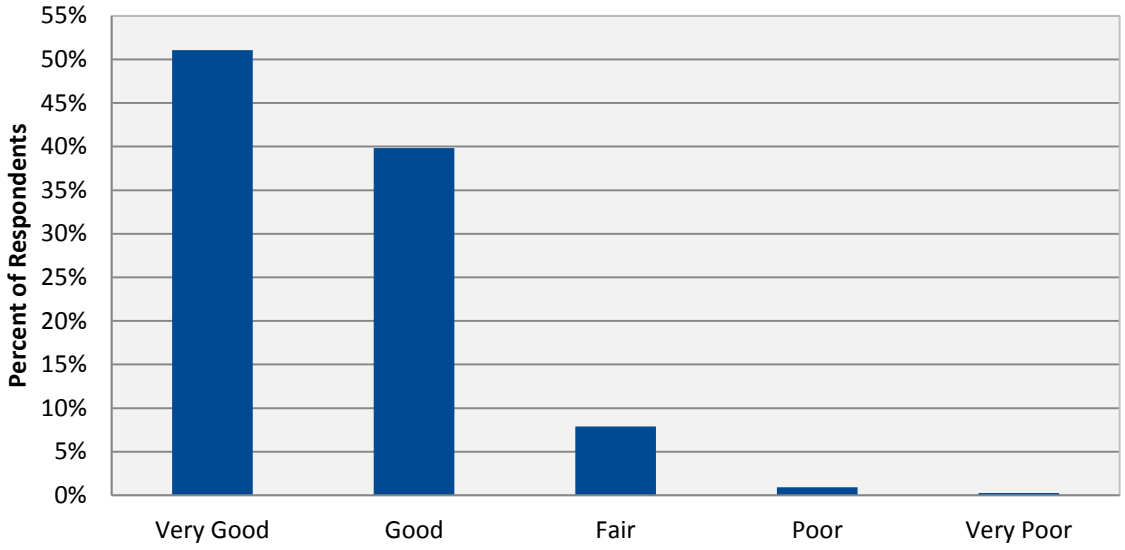


Figure 28: How would you rate safety at the CU Transit bus stops?

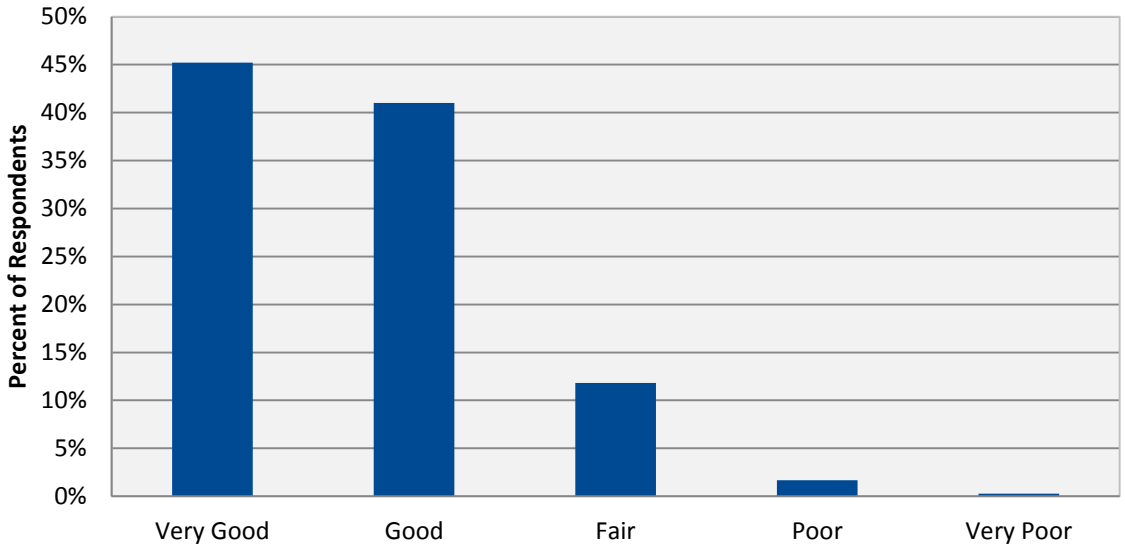


Figure 29: How would you rate the courtesy of bus drivers?

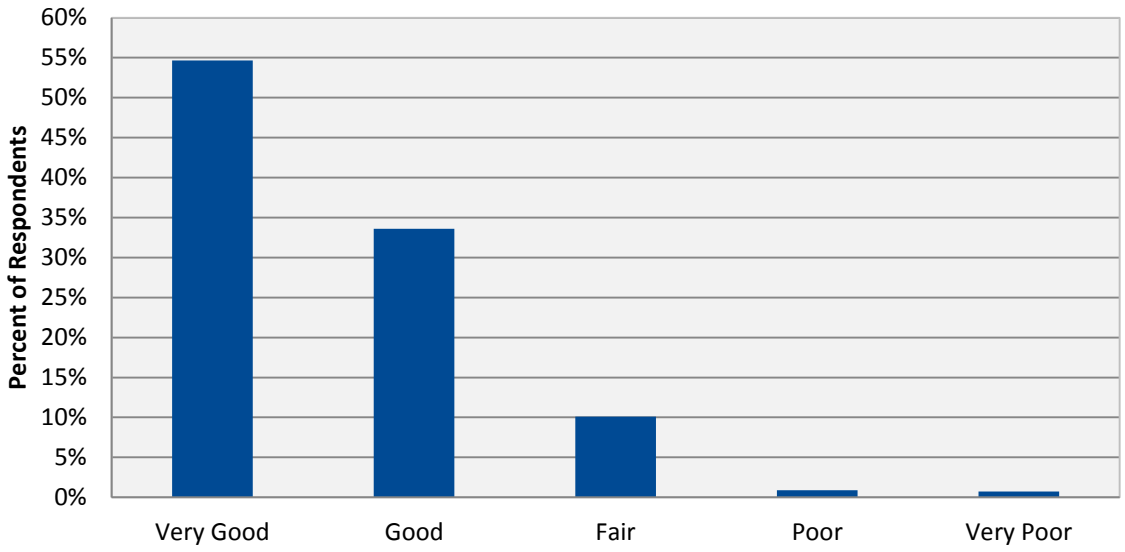


Figure 30: How would you rate the frequency of current CU Transit service (how often buses run)?

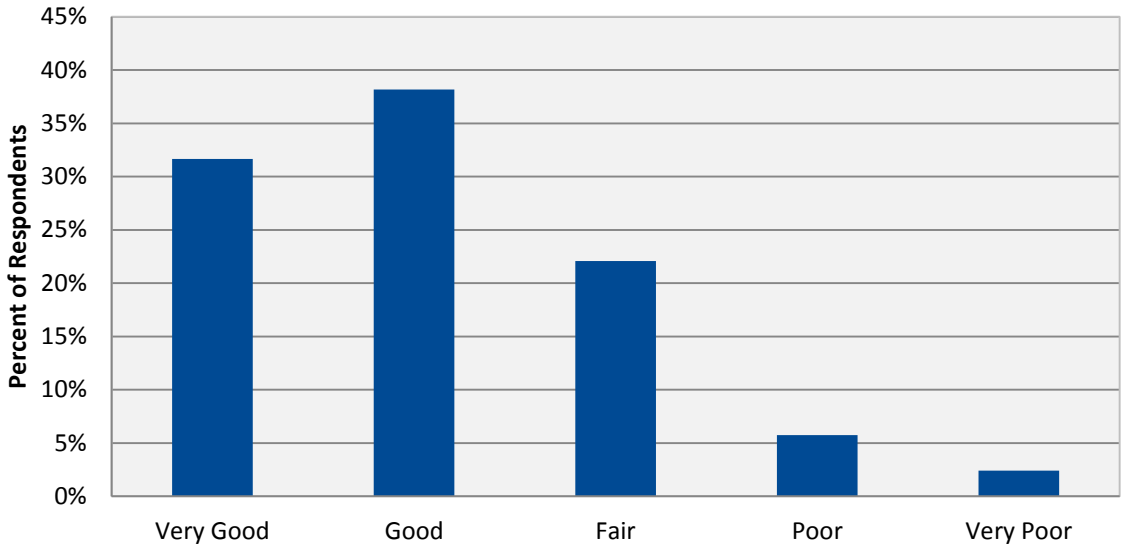


Figure 31: How would you rate how early/late the current buses run on weekdays?

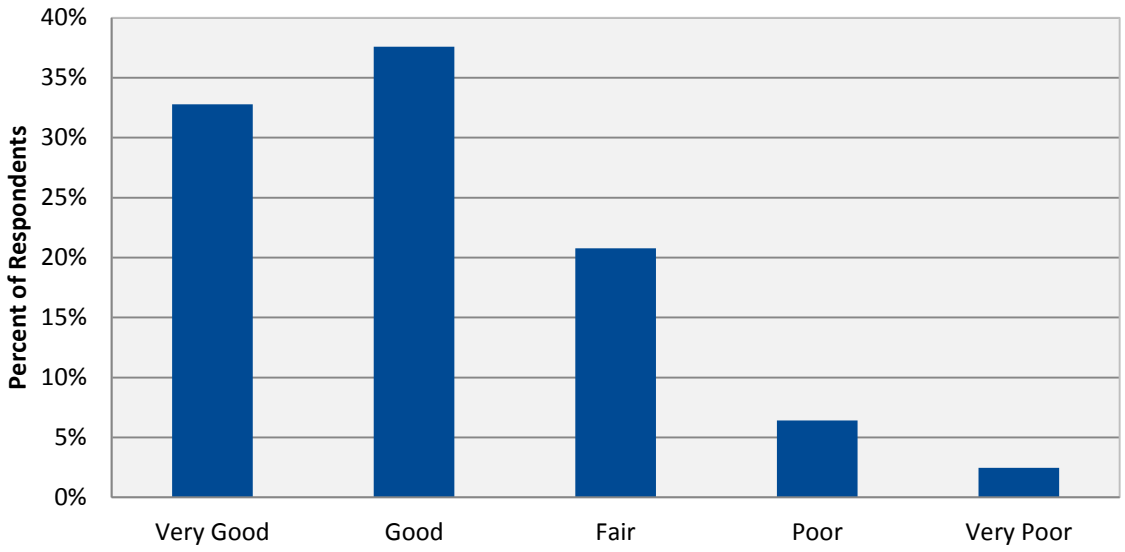


Figure 32: How would you rate how early/late the current buses run on Saturdays?

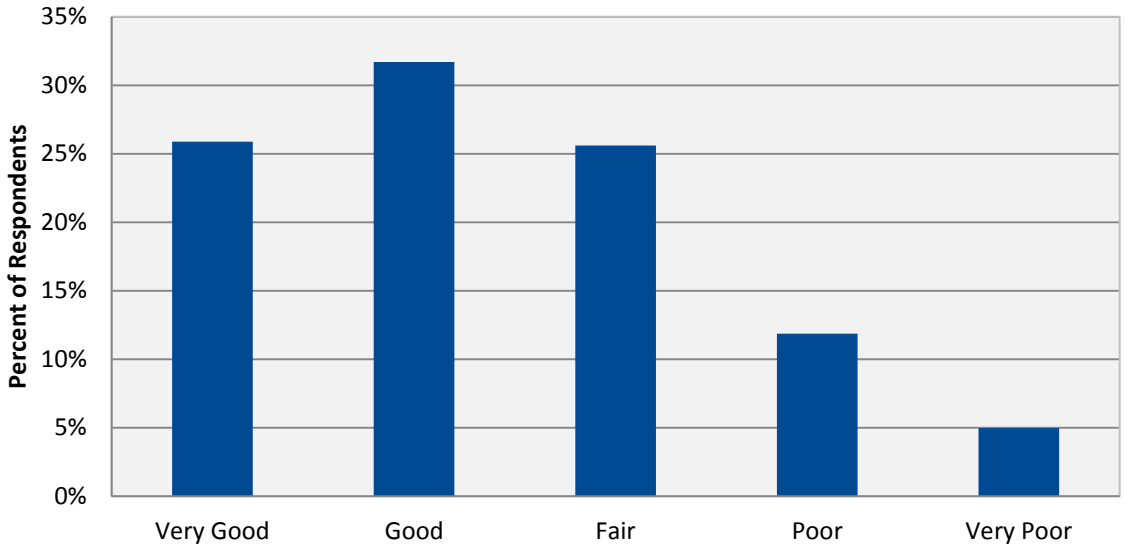
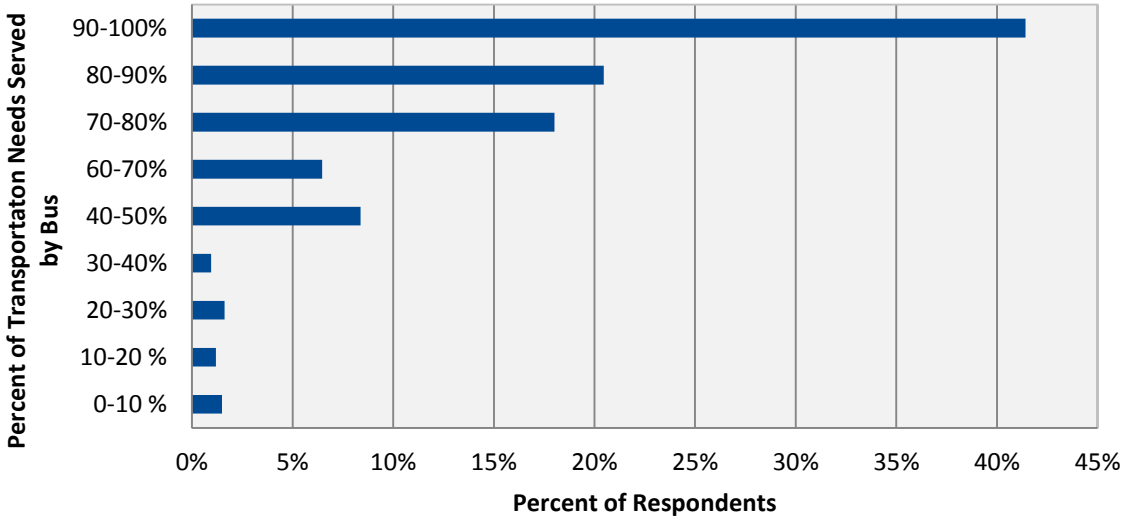


Figure 33: What percentage of your transportation needs is served by the bus?



Survey respondents said that on average, 82.3 percent of their transportation needs were adequately served by the bus. This is a very high level of satisfaction, indicating a modest need for service changes.

Figure 34: At what point would you begin riding less if fares increased?

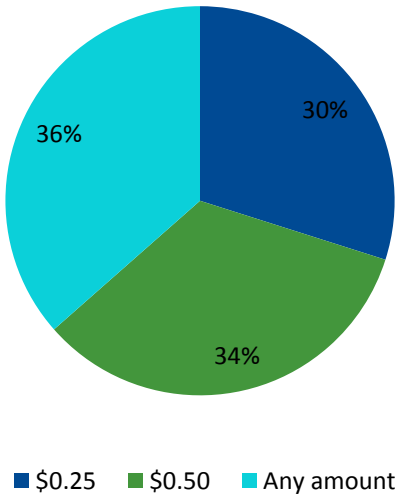
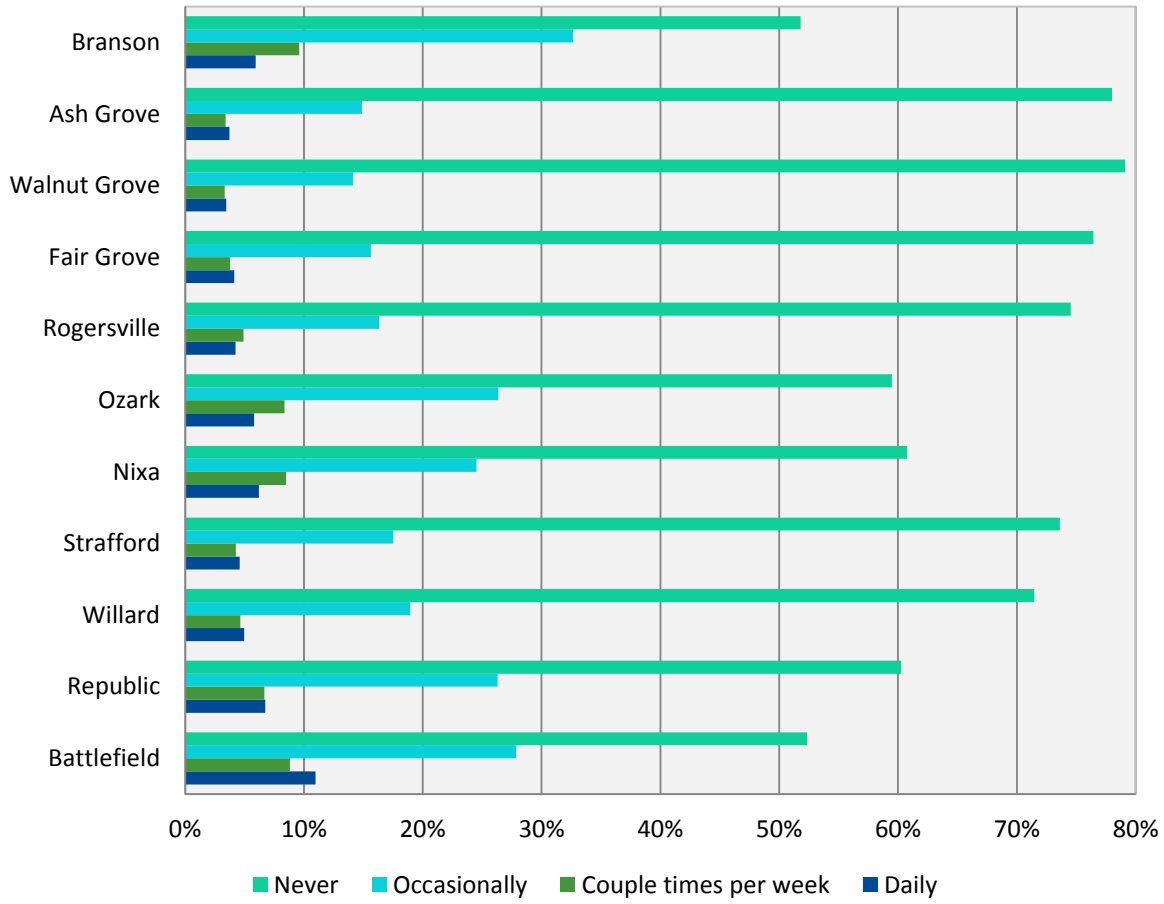


Figure 35: How often would you use a regional service to other nearby cities?



The on-board survey asked respondents for their opinion on how CU transit service could be improved. Some of the reoccurring themes and responses to this question include:

- More service on evenings and weekends
- More frequent service- 15, 20, 30 minute frequencies
- On-time performance issues; buses leaving early and/or late
- The desire for larger buses
- The desire for later evening service
- Fare prices- too high

The following figures are a summary of the demographics of the survey respondents.

Figure 36: Age

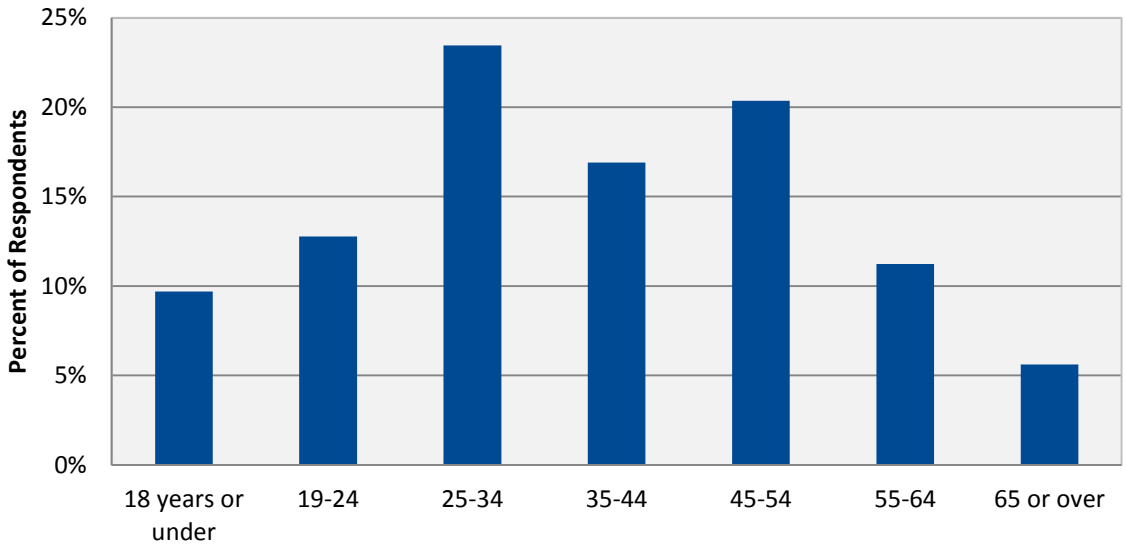


Figure 37: Race

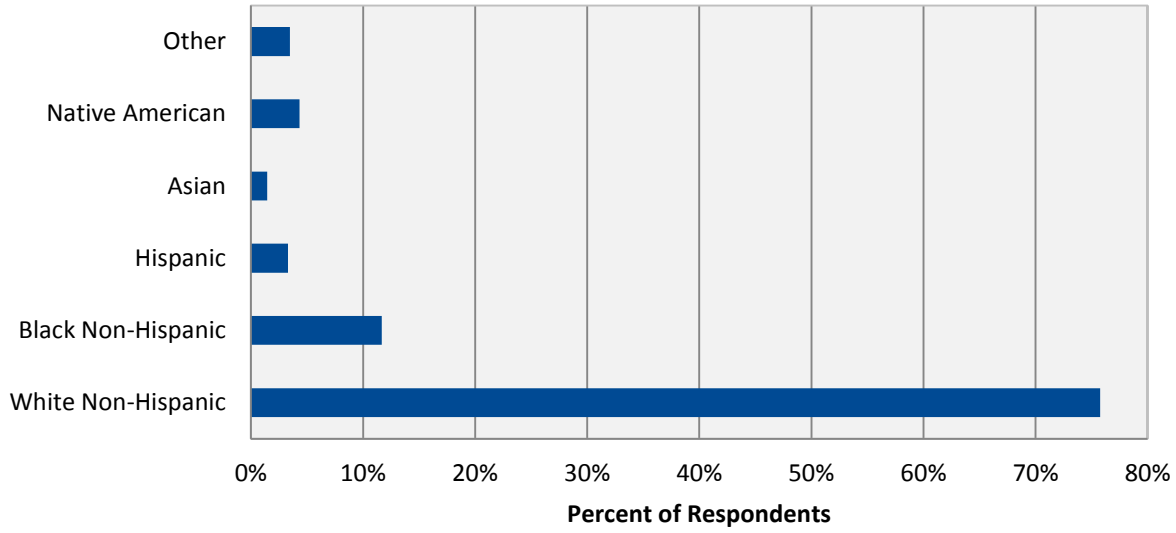


Figure 38: Gender

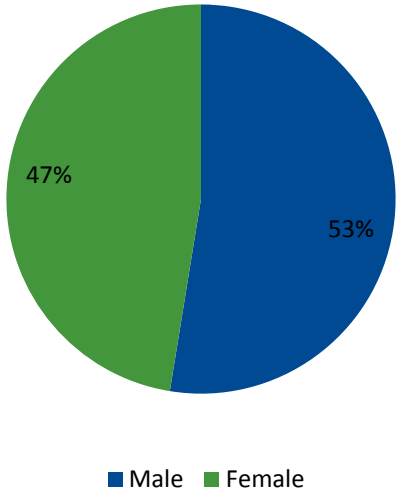
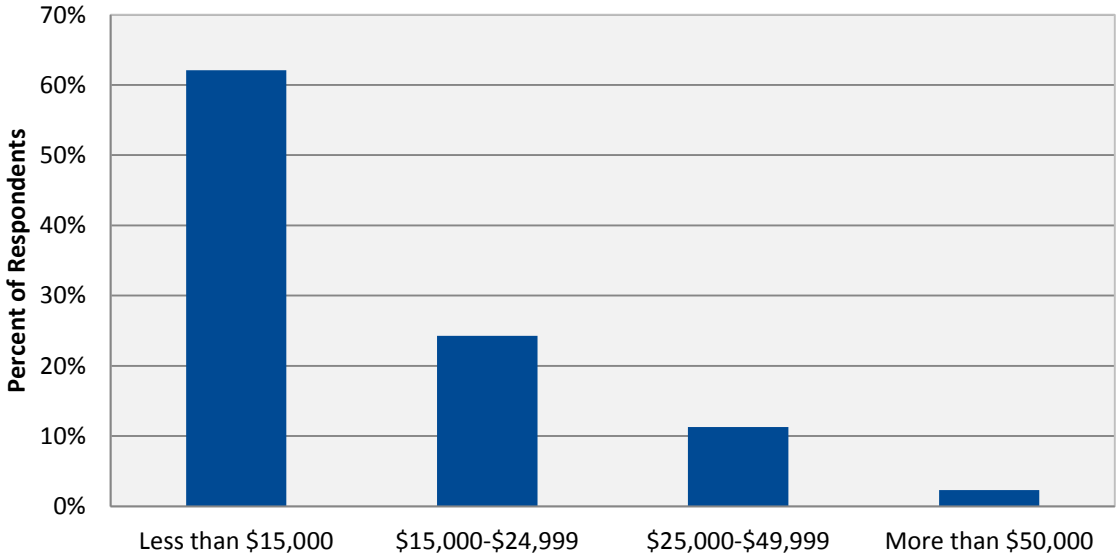


Figure 39: Range of total household income in 2010



Additional Analysis of On-Board Survey Results

Based on the results of the on-board survey, additional analyses were conducted to help identify passenger trends. These additional results are presented in the following figures.

Figure 40 illustrates the overall satisfaction with CU service of passengers riding CU for less than one year, one to five years, and over five years.

Figure 40: Overall satisfaction with CU Transit

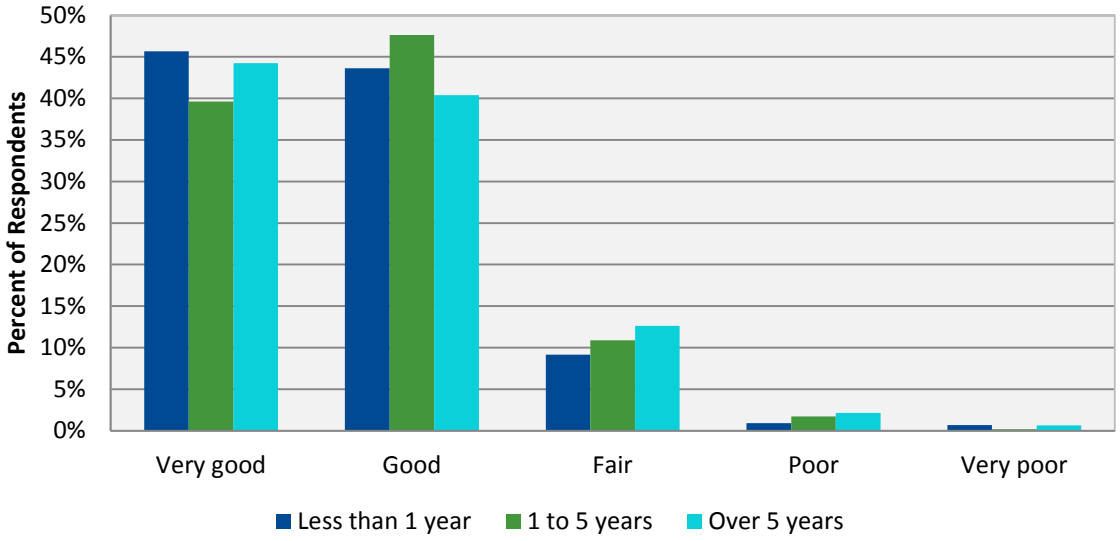


Figure 41 shows the trip purpose of every day riders. Nearly 45 percent of the respondents who identified themselves as daily riders have a trip to/from work.

Figure 41: Trip Purpose of Everyday Riders

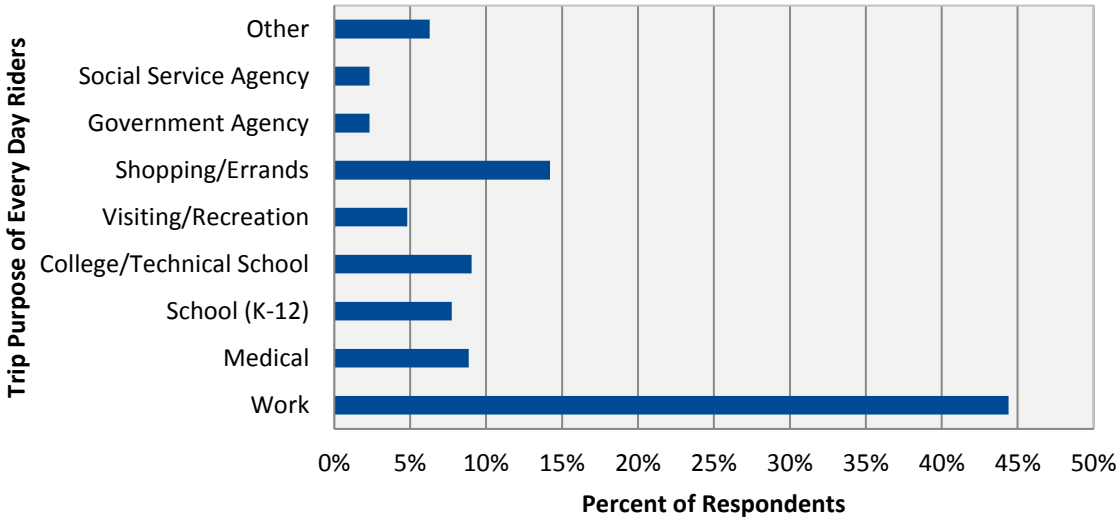


Figure 42 shows the level of satisfaction of the every day riders. Over 80 percent of every day riders claimed that their overall satisfaction with CU Transit was very good or good.

Figure 42: Overall Satisfaction of Every Day Riders

Figure 43 shows the percent of transportation needs met by CU of every day riders. Nearly 80 percent of every day riders stated that at least 80 percent of their transportation needs are being met by CU.

Figure 43: Percent of Transportation Needs Met of Every Day Riders

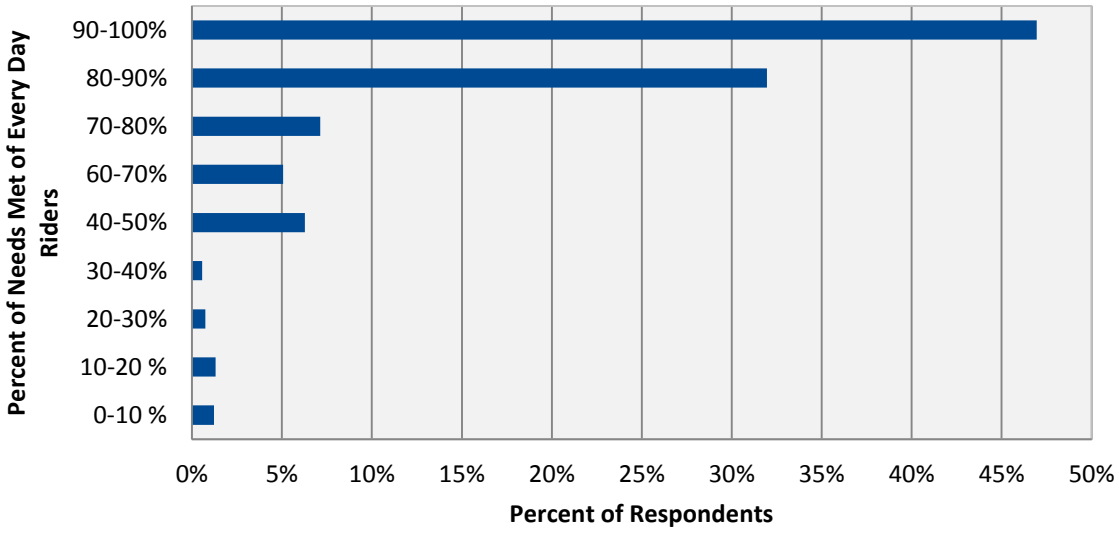


Figure 44 shows the relationship between the trip purpose and the number of years the survey respondents have been using CU buses. Most survey respondents stated work as the purpose of their trip regardless of how long they have been using CU buses.

Figure 44: Trip Purpose by Transit User

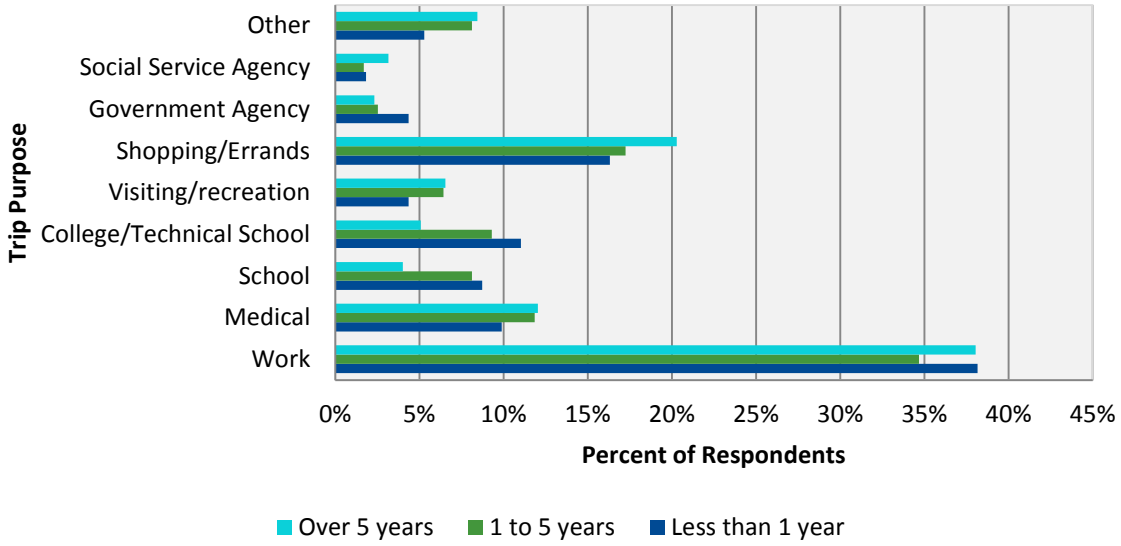
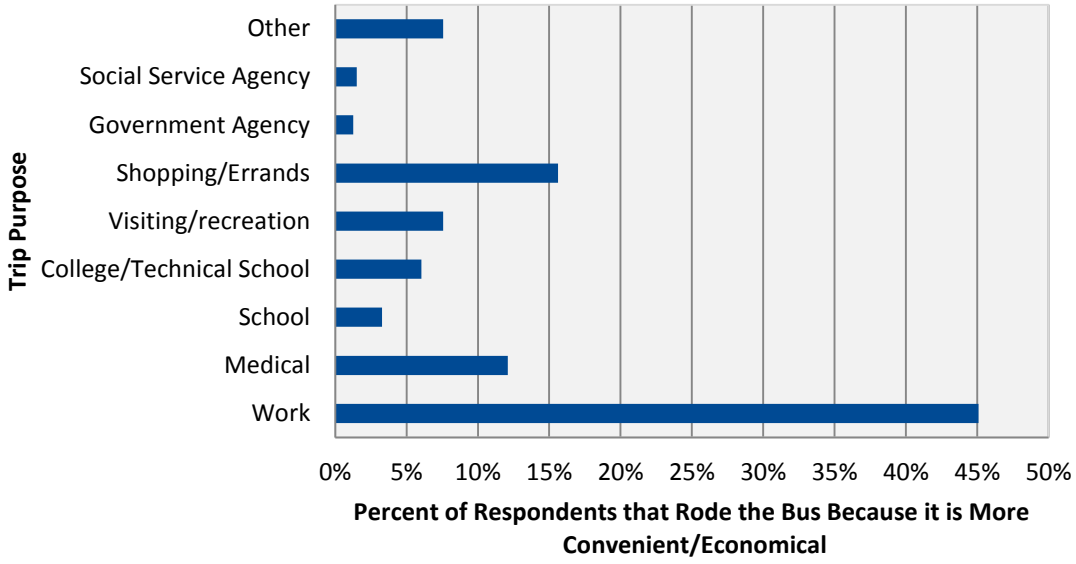


Figure 45 shows the trip purpose of respondents who chose to ride the bus because it was more convenient/ economical. The majority of these respondents had a trip purpose to/from work.

Figure 45: Trip Purpose of Respondents who Chose the Bus due to Convenience/Economy



Passenger Vignettes

Passenger vignettes provide a sample of the trip purposes of typical CU customers. These vignettes paint a picture of the type of passengers and the kinds of trips that might be affected by service changes. Passengers often suggest minor improvements that they would like to see to make their transit system better. Following are passenger vignettes gathered during interviews conducted in November 2011.

- **Larry** is 41 years old and has been riding CU buses for about 30 years. Typically, he uses his bicycle for most of his life activities; however, he also rides CU buses two to three times per week. He has worked at many different locations around Springfield over the years. Today he is working on demolishing homes near MSU and was too tired to ride his bicycle all the way home. He made it to the Park Central Transfer Station and decided to take the bus the remainder of the way home. Larry would like the fare lowered because the current $1.25 fare is too high for him.
- **Laura** works at Republic and Glenstone in an assisted living facility for Alzheimer's patients. She really likes her job, but she has to walk 1.2 miles from the end of Route 5-S. Glenstone to get to her job, and then 1.2 miles at the end of the day to catch the bus. There is no sidewalk and she walks in the grass. She has been working at this job for four months and is concerned about how difficult it will be in the winter. She lives along Route 6-College and allows two hours to get to work in case she misses her transfer and then has to wait 30 minutes for the next bus. Normally, she gets to work about an hour early when everything works well. She likes the 20 minute interval in the afternoon because it gives her more choices if she does some shopping at WalMart. Her 16 year old son is autistic and she is teaching him to ride the bus. Most of the drivers are really good about helping her teach him to ride the bus. She would like the buses to always operate on time.
- **Michelle** is riding Route 15-E. Kearney even though her destination is on Route 10-Cedarbrook. She rides Route 4-S. Glenstone to Division and Glenstone, then takes Route 10-Cedarbrook northbound and stays on the bus as it turns into Route 15-E. Kearney and then back to Route 10-Cedarbrook. She gets off on Division Street near her job. She does not like riding Route 10/15 for almost 50 minutes; she would like Route 10-Cedarbrook to run more often. She buys the seven day pass for $13.00 and thinks it is a good deal, but would like it to be extended for one day when she does not ride on Sunday. She usually rides six to seven days per week. She used to buy the day pass, but it is too expensive for her. She likes how easily she gets the weekly pass in the mail.
- **Brent** boarded Route 12-S. National at 4:20 p.m. at Cox Hospital. His truck had broken down on his way to work in the morning and his son gave him a ride. This was the first time he had ever tried to ride a CU bus. He knew buses ran around Springfield, but did not know which bus to take home. He did not know the fare, the route, the schedule or the need to transfer. He lives on the north end of Route 1-N. Kansas Expressway. Another passenger, **Barbara**, was waiting at the shelter and she explained how to ride the bus. When he boarded the bus, the driver was very helpful explaining the fares, where and how to transfer, and how long he would have to wait for Route 1-N. Kansas Expressway downtown.

  We checked the schedule for the next morning and he would have to get on Route 1-N. Kansas Expressway at 6:10 a.m. While trying to figure out the connecting route on the schedule he determined that he would arrive at 7:20am if he takes Route 12-S. National. Because the printed

schedule does not have a time-point listed as Cox, it is difficult for a new passenger to determine the correct arrival time. The actual arrival time on Route 7-S. Campbell would be 7:02 a.m. If he takes Route 7-S. Campbell, he would arrive at about 6:55 a.m., which would give him adequate time to get to his work station and punch in before his scheduled start time of 7:20 a.m. When he drives to work, he normally leaves home at 6:40 a.m. to arrive in time. Taking the bus would require an extra 30 minutes per day for the morning trip. He indicated that he thought a reasonable price for a monthly pass would be $60. The $45 monthly pass fare appealed to him, but the additional hour of daily travel time was not appealing.

- **Barbara**, who helped Brent figure out how to use the bus, is a regular rider and has been riding for about 20 years. She is currently unemployed and was at Cox Hospital applying for a job. Today she was riding downtown to transfer to Route 14-W. Atlantic to go home. She is very satisfied with the service and rarely has a problem with missed connections; however, when she rides Route 5-S.Glenstone, it is usually late. She appreciates the low floor buses because one of her good friends uses a wheelchair. The old high floor lift buses had lots of problems and she likes the low floors. She enjoys helping other passengers figure out which bus to use when they are going somewhere unfamiliar.

It should be noted that customer input like these passenger vignettes were considered during subsequent analysis steps, but only those ideas that could generate significant ridership increases were incorporated into formal recommendations.

System Performance Analysis

This section describes the service design evaluation measures used to evaluate the CU system configuration. These measures are based on the University of Southern Florida Center for Urban Transportation Research (CUTR) *Best Practices in Transit Service Planning*.

In addition to the CUTR evaluation measures, a level of service (LOS) assessment was also completed. The LOS assessment can serve as a "report card" to gauge the system's performance relative to a set of national benchmarks. Each quality-of-service factor measured in this analysis is important to CU's operations, as each directly influences how passengers perceive the quality of a transit trip. Levels of service are graded on an A-F scale according to a traveler's point of view, with "A" representing an optimum condition and "F" representing an undesirable condition.

The levels of service and methodologies employed in this analysis are derived from the *Transit Capacity and Quality of Service Manual* (TCQSM), TCRP Report 100. It is important to note that the LOS assessment is not a definitive rating of the system's performance and local decision makers should employ their own locally developed standards to rate service. LOS assessments are often used to measure year-to-year improvements in the service provided.

Service Availability

Service availability measures the passenger's ability to access and use transit. The standards for service availability that were used for CU include service coverage, and stop spacing.

Service Coverage

Service coverage measures the area within walking distance of transit stops. The more area covered by transit, the greater the geographic availability of transit. Industry standard minimum densities are used in this analysis.

A residential density of three housing units per gross acre is considered the minimum density capable of supporting a basic level of transit service (at 60-minute headways). An employment density of four or more jobs per acre is also considered capable of supporting the basic level of service. Places that meet this threshold are referred to as transit-supportive areas (TSAs) in this analysis. Areas within ¼ mile of bus routes are considered covered by transit service.

Figure 46 illustrates the distribution of transit-supportive areas within the Springfield urbanized area, along with the area within ¼ mile of regular bus routes. TSAs are calculated at the Census block level. Approximately 30 percent of the gross area within the Springfield urbanized area is considered transit supportive, a total of 15,950 acres, as shown in Table 6. These areas are represented in Figure 46 in orange and purple. The green ¼-mile route service area is overlaid on transit-supportive areas to determine service coverage. A total of 12,764 acres of transit-supportive area are located within ¼ mile of a CU route, or 80 percent of the total transit-supportive area. The remaining 20 percent of transit-supportive area is outside the ¼-mile service area.

Figure 46: Transit-Supportive Areas and Fixed Route Coverage

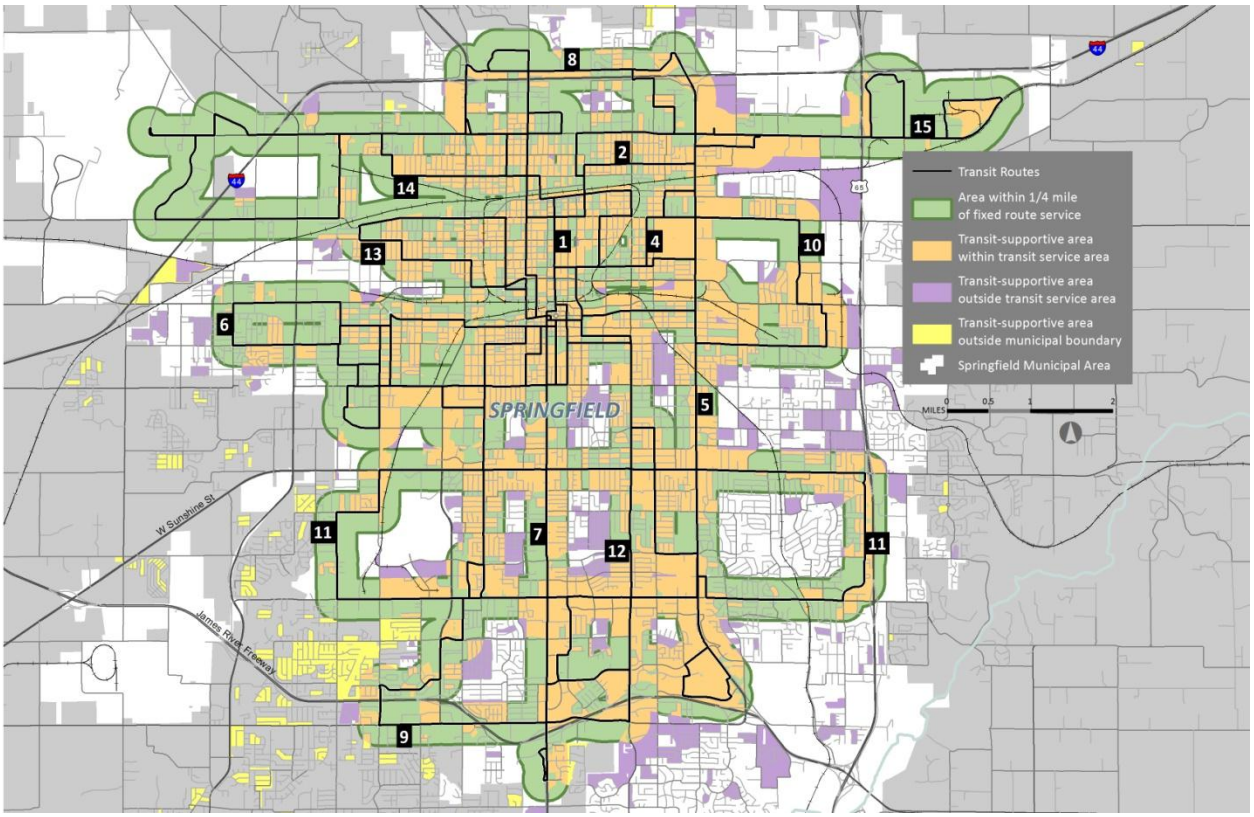


Table 6: Summary of Transit-Supportive Area Analysis

Definition of Area	Area (acres)	Percent of Total
Springfield urbanized area (city limits)	52,637	--
Transit-supportive area (outside city limits)	130	
Transit-supportive area (city limits+130 acres outside city)	16,080	--
Within ¼ mile of transit route	12,626	79%
Not within ¼ mile of transit route	3,454	21%

CU performs at a "B/C" level of service for system coverage of transit-supportive areas within the Springfield city limits. As noted in Table 7, this level of service means generally that most major origins and destinations are served.

Table 7: Fixed-Route Service Coverage LOS Assessment (TCQSM)

LOS	% TSA Covered	Comments
A	90.0–100.0%	Virtually all major origins & destinations served
B	**80.0–89.9%**	**Most major origins & destinations served**
C	**70.0–79.9%**	**About ¾ of higher-density areas served**
D	60.0–69.9%	About two-thirds of higher-density areas served
E	50.0–59.9%	At least ½ of the higher-density areas served
F	<50.0%	Less than ½ of higher-density areas served

Bus Stop Spacing

Bus stop spacing is the distance between adjoining service stops on a route. Bus stop spacing has a major impact on the performance of a transit system. Stop spacing affects the overall travel time and, as

a result, the demand for transit. Table 8 lists the number of stops per mile by each route as well as the system average. CU has a system average of 5.8 stops per mile which is reasonable.

Table 8: Fixed Route Stop Spacing

Route	Stops/Mile
1	7.3
2	7.0
4	6.6
5	4.8
6	6.0
7	5.2
8	4.9
9	6.8
10	5.6
11	4.9
12	5.9
13	6.2
14	7.3
15	3.0
System Average	5.8

Travel Time

Travel time standards provide guidance on the schedule design functions of a transit system. Standards for this category address service frequency, service directness, and span of service.

Service Frequency

Service frequency is a measure of how many times an hour a user has access to bus service, given reasonable service coverage and hours of service that make a transit trip possible. Table 9 lists the frequencies and headways of each weekday route in the CU system. Eight routes operate on 30-minute base weekday headways; another 7 routes operate at 60-minute weekday headways. Route 5-S. Glenstone operates on a 20-minute headway after 2:00 p.m. on weekdays. Table 10 lists the night and weekend frequencies. All night and weekend routes operate at 60-minute headways.

Table 9: Weekday Headway/Frequency by Route

Scheduled Headway	Vehicles/hour	Routes[3]
20	3	5
30	2	1,2,5,6,7,9,12,14
60	1	4,8,9,10,11,13,15

Table 10: Night and Weekend Headway/Frequency by Route

Scheduled Headway	Vehicles/hour	Routes
60	1	22,25,26,27

The 30- and 60-minute headways in the CU system equate to a “D” and “E” level of service, respectively, as noted in Table 11. This level of service is generally considered to be unattractive to choice riders, but still available within an hour.

[3] Route 9 has a 30 minute frequency after 2:35 p.m. Route 5 has a 20 minute frequency after 2:00 p.m.

Table 11: Headway/Frequency LOS Assessment (TCQSM)

LOS	Average Headway (min)	Vehicles/hour	Comments
A	<10	>6	Passengers do not need schedules
B	10-14	5-6	Frequent service, passengers consult schedules
C	15-20	3-4	Maximum desirable time to wait if bus/train missed
D	**21-30**	**2**	**Service unattractive to choice riders**
E	**31-60**	**1**	**Service available during the hour**
F	>60	<1	Service unattractive to all riders

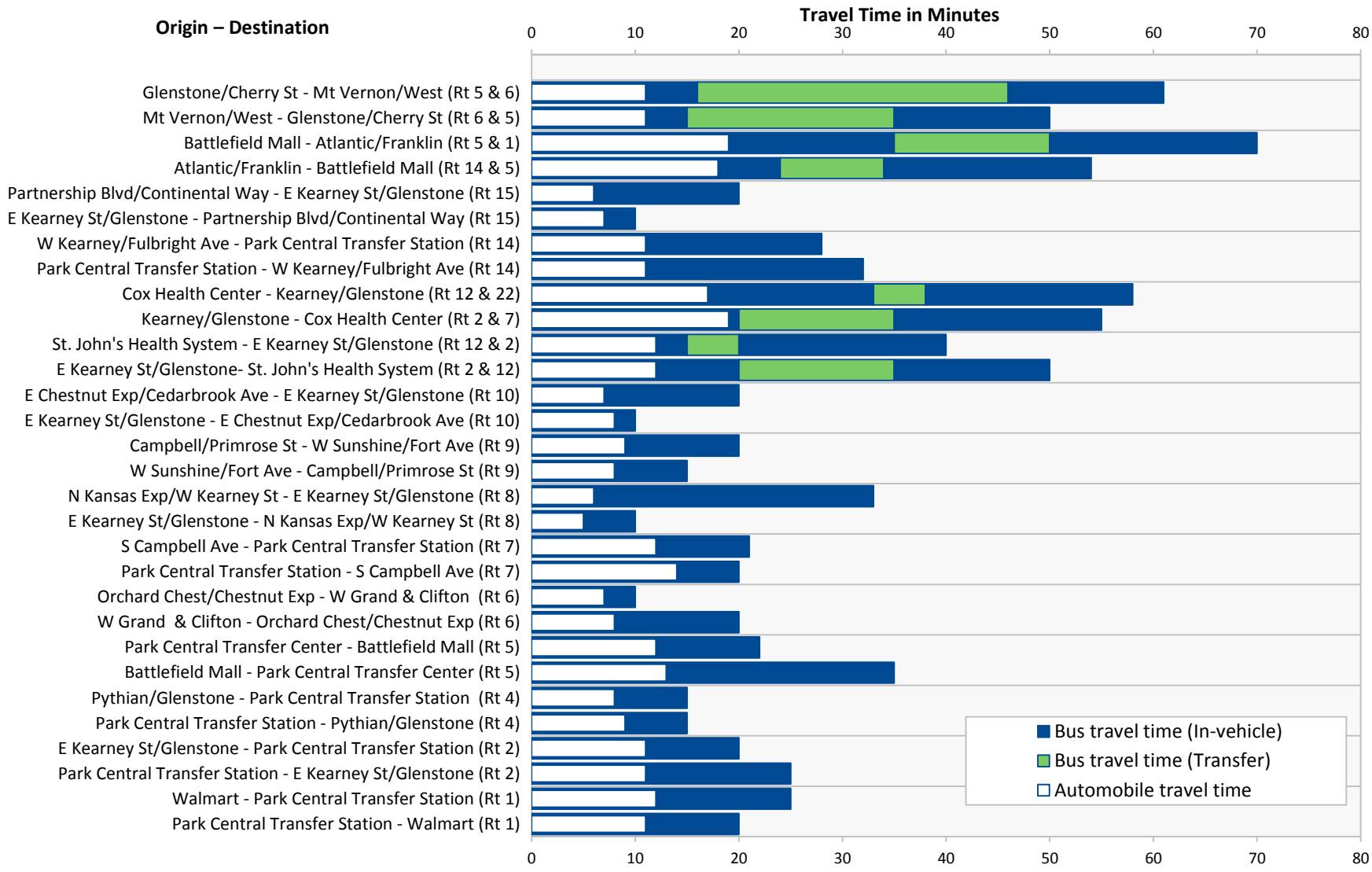
Transit-Auto Travel Time

Transit travel time relative to auto travel time is important because most choice riders will prefer to drive their own cars unless transit travel time is competitive with the car. To compare scheduled bus travel times with auto travel times, a number of trips across the Springfield area were analyzed. The selection of trips includes a combination of one-seat rides and trips requiring one transfer. CU route schedules were used to plan trips between two time-points. In each case, trips were planned during the midday period, and one hour of time was allotted between arriving at the destination and departing to complete a round trip. Google Maps driving directions were used to estimate comparable auto travel times.

Figure 47 summarizes the travel time analysis. The blue bars represent time spent in a bus, while the green bars represent the transfer time between connecting buses. For this travel time analysis, the average trip takes almost three times longer by bus than by auto[4]. For the selected trips, the average one-way travel time using bus is 29 minutes, compared to an average auto travel time of 11 minutes. The average travel time difference for these trips is 18 minutes, including an average transfer penalty of 10 minutes.

[4] The average commute time for the CU transit system is 17 minutes, as reported in NTD.

Figure 47: Automobile vs. Bus Travel Time Comparison for Selected Trips



Based on the TCRP level of service assessment shown in Table 12, CU receives a C grade for travel time competitiveness.

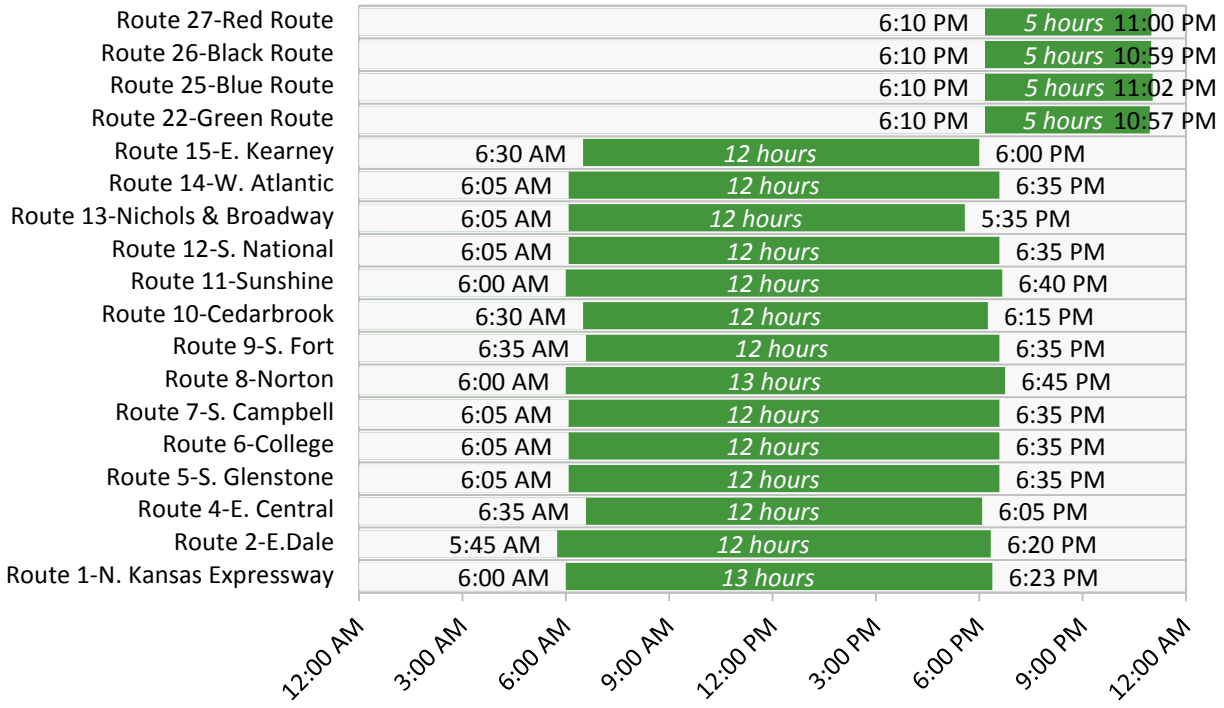
Table 12: Transit-Auto Travel Time LOS (TCQSM)

LOS	Travel Time Difference (min)	Comments
A	≤0	Faster by transit than by automobile
B	1–15	About as fast by transit as by automobile
C	16–30	Tolerable for choice riders
D	31–45	Round-trip at least an hour longer by transit
E	46–60	Tedious for all riders; may be best possible in small cities
F	>60	Unacceptable to most riders

Service Span

Hours of service, or service span, is a measure of the number of hours during the day when a customer could potentially make a trip using the bus. Hours of service are calculated by subtracting the time of the last outbound departure from the first departure, adding one hour, and rounding down any fractions of hours. Only routes that provide at least hourly service are included in the analysis. Figure 48 illustrates each route's weekday hours of service.

Figure 48: Weekday Hours of Service on Fixed Routes



A system-wide assessment of this measure is possible because CU provides hours of service at a fairly consistent level throughout the system. System-wide, CU provides an average of 17 hours of service on weekdays on its fixed routes. Based on the TCQSM level of service assessment shown in Table 13, CU receives a B grade for hours of service on weekdays.

Table 13: Hours of Service LOS Assessment (TCQSM)

LOS	Hours of Service	Comments
A	19–24	Night or "owl" service provided
B	**17–18**	**Late evening service provided**
C	14–16	Early evening service provided
D	12–13	Daytime service provided
E	4–11	Peak hour service only or limited midday service
F	0–3	Very limited or no service

Service Delivery

Service delivery standards involve the direct impact on the customers and how they perceive the service. They include aspects such as on-time performance, passenger shelters and other amenities, customer service, and safety issues.

On-Time Performance

On-time performance is the most widely used service reliability measure in the transit industry. A majority of systems define a route as being late if it is late over five minutes. Most systems also define a route as early even if it is one minute early. CU defines on-time as 0-5 minutes late; and, running ahead of schedule is not considered adhering to the schedule.

This analysis uses data from samples taken between October 2010 and September 2011. CU field supervisors conduct on-time checks as part of their regular duties and record trips as late if they are five or more minutes behind schedule at time-points. Of the 846 trips included in the sample, 48 were marked late, resulting in an on-time percentage of 94.33 percent for the sampled period. This equates to a "B" level of service, as indicated in Table 14. At this level of on-time performance, the average rider experiences one late vehicle on average every week.

Table 14: On-Time Performance LOS Assessment (TCQSM)

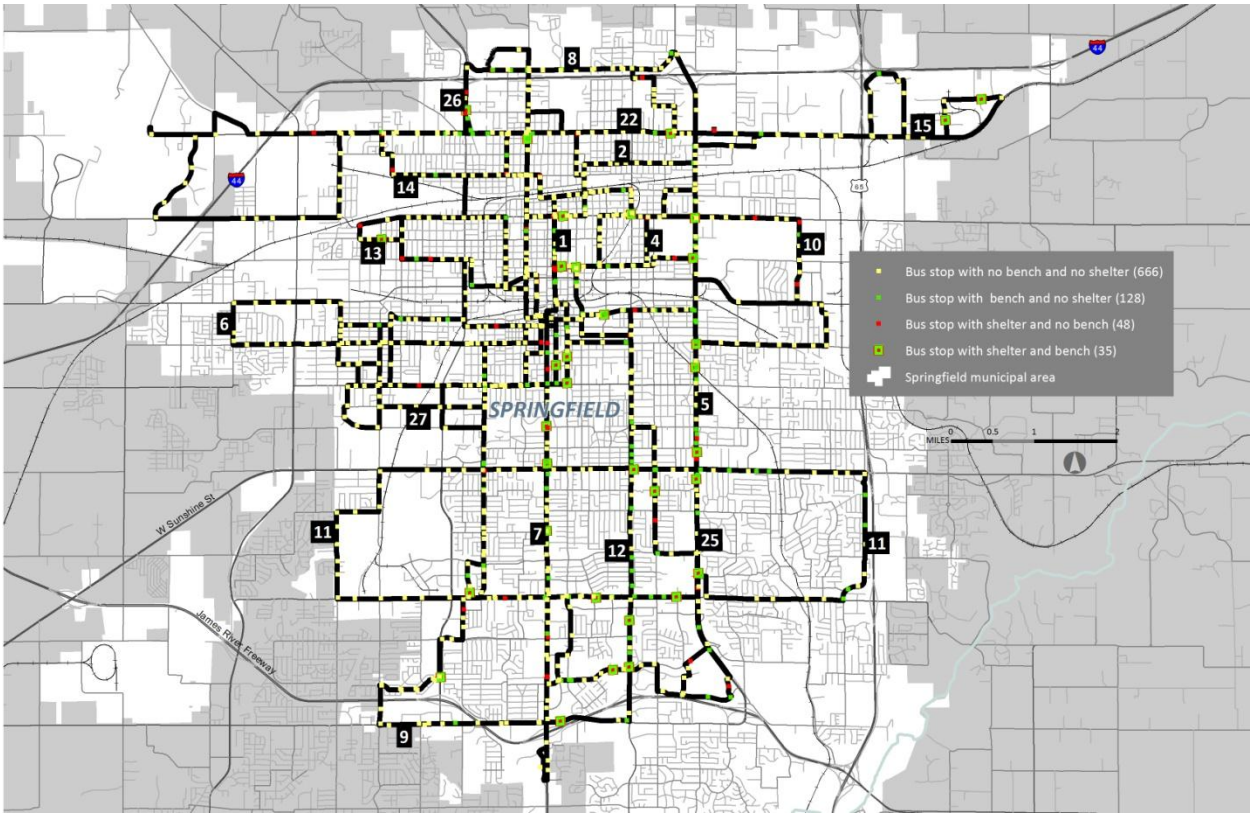
LOS	On-Time Percentage	Comments[5]
A	95.0–100.0%	1 late transit vehicle every 2 weeks (no transfer)
B	**90.0–94.9%**	**1 late transit vehicle every week (no transfer)**
C	85.0–89.9%	3 late transit vehicles every 2 weeks (no transfer)
D	80.0–84.9%	2 late transit vehicles every week (no transfer)
E	75.0–79.9%	1 late transit vehicle every day (with a transfer)
F	<75.0%	1 late transit vehicle at least daily (with a transfer)

[5] Based on individual's perspective, given 5 round trips per week

Number of Bus Shelters/Benches in System

The location of passenger shelters and benches is another area of service delivery. Transit systems should strive to place its shelters and benches in the locations that will create the greatest benefit for its customers. Generally, this occurs at the stops that have the highest utilization. As shown in Figure 49, there are 877 bus stops in the CU system. Of the 877 bus stops, 83 (10 percent) have shelters, and 128 (15 percent) have benches.

Figure 49: Number of Bus Shelters and Benches



Safety

The most common safety measure tracked by transit agencies is the number of accidents per miles operated. In 2011, CU had 14 preventable accidents while travelling 1,270,300 miles. A desired accident rate is less than one accident per 100,000 miles. CU is slightly above the desired accident rate.

Customer Complaints

Many agencies track the number of customer complaints on an annual basis. Currently, CU does not track customer complaints. It is recommended that in the future, customer complaints are tracked. CU should track the number of valid complaints per driver. A complaint is determined valid after it is investigated.

Vehicle Standards

Vehicle standards address the various service planning aspects of operating transit vehicles such as the assignment of vehicles, utilization and efficiency, and reliability and condition.

Average Fleet Age

CU has a fixed route fleet comprised of 25 vehicles. Table 15 is an inventory of the CU buses.

Table 15: Vehicle Inventory Summary

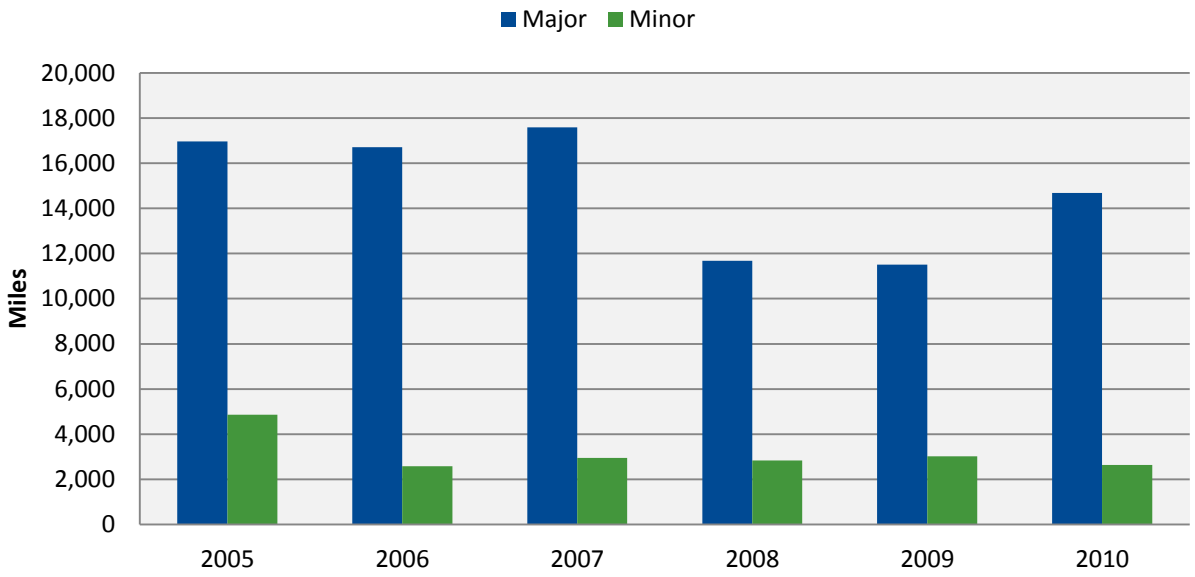
Make	Model Year	Number of Buses	Age
New Flyer	1997	10	14
New Flyer	2000	13	11
Gillig	2005	2	6
Fleet Average Age			11.8

The average age of the fleet is 11.8 years.

Miles Between Road Calls

Vehicle miles between road calls is a common measure of vehicle reliability. Greater miles between road calls means that the number of road calls is less often and is a sign of better vehicle reliability. Figure 50 shows the vehicle miles between major and minor road calls between 2005 and 2010. In 2008 and 2009, miles between major road calls decreased; however, in 2010 the miles between major road calls increased.

Figure 50: Miles Between Major and Minor Road Calls, 2005-2010



Spare Factor

The spare ratio measures the ratio of vehicles in the fleet above what is required to operate the service in the peak period. CU has a fixed-route fleet comprised of 25 vehicles. Of these vehicles, 20 are used for peak operations, and 5 are used as spares. This results in a spare ratio of 25 percent, which is higher than desirable but acceptable for systems with less than 50 peak vehicles.

Service Equity

Service equity refers to the equitable distribution of services for all population groups, especially minority populations. Title VI of the Civil Rights Act of 1964 governs service equity and requires transit providers to develop service standards to assure that service is provided in an equitable, nondiscriminatory manner. FTA requires that transit service policies and standards be established for specific items including vehicle headway and distribution of transit amenities. Although a Title VI analysis is not included in this report, minority populations are important to consider as service changes are considered and eventually implemented. The measures evaluated for this analysis include service frequency and passenger shelters in minority and low-income areas.

Minority Populations

The minority population within Springfield is 13.2 percent. Areas with minority populations greater than 13.2 percent are defined as predominately minority areas as shown in Figure 51.

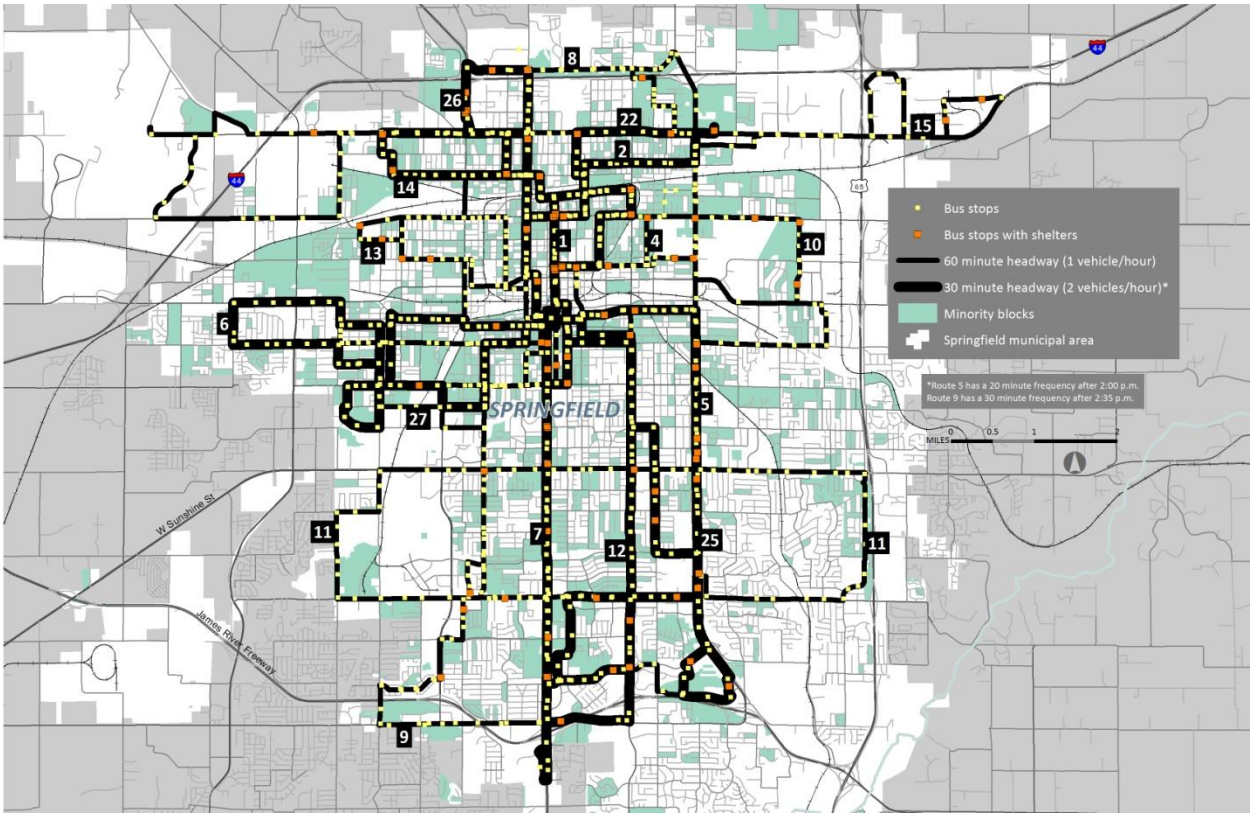
Service Frequency

Bus frequencies are also shown on Figure 51. Based on a visual analysis of the figure, it does not appear that minority blocks have disproportionately less frequent service than non-minority blocks.

Passenger Shelters

Based on a visual analysis of Figure 51, it does not appear that minority blocks have disproportionately less passenger shelters than non-minority blocks.

Figure 51: Minority Blocks



Low-Income Populations

Based on American Community Survey (2005-2009) data, the average low-income percentage of the Springfield area is 29.5 percent. Areas with low-income populations greater than 29.5 percent are defined as predominately low-income areas as shown in Figure 52.

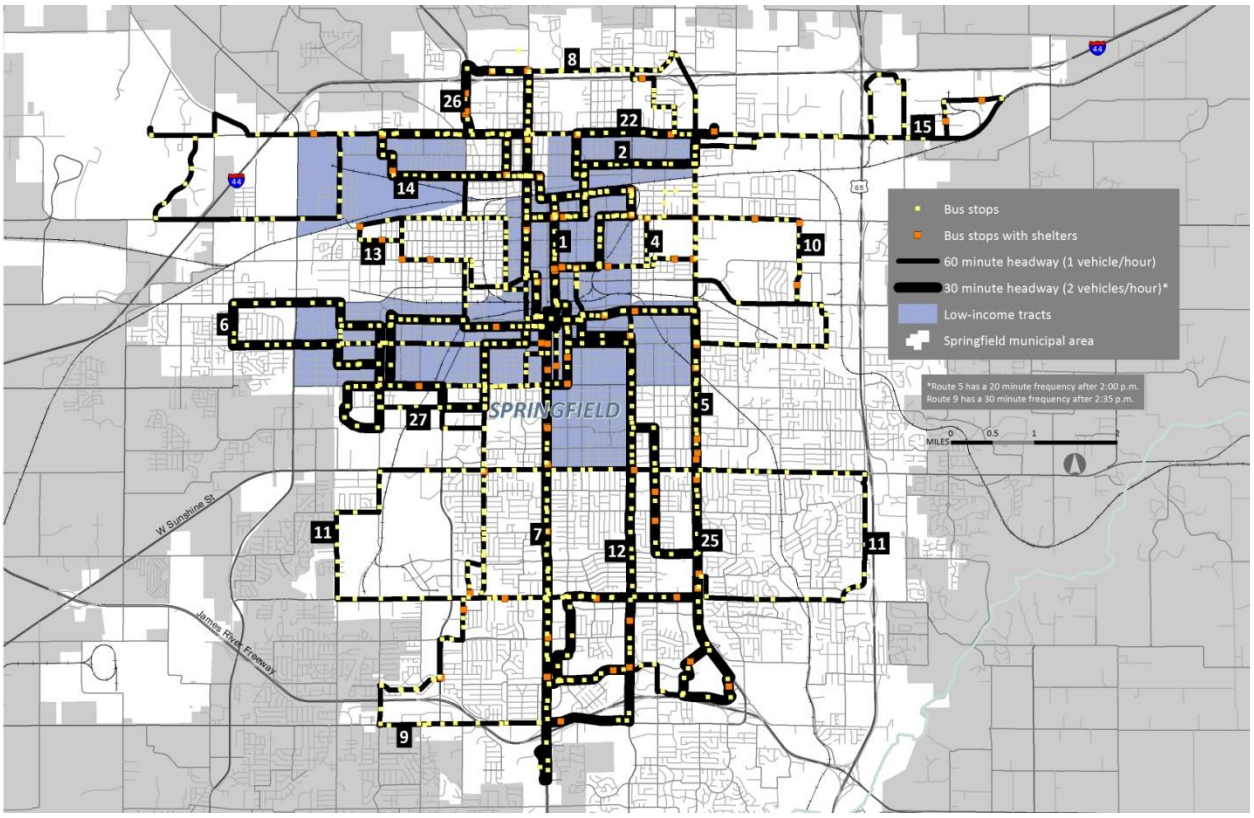
Service Frequency

Bus frequencies are also shown on Figure 52. Based on a visual analysis of the figure, it does not appear that low-income areas have disproportionately less frequent service than non low-income areas.

Passenger Shelters

Based on a visual analysis of Figure 52, it does not appear that low-income areas have disproportionately less passenger shelters than other non low-income areas.

Figure 52: Low-Income Tracts



Peer Group Analysis

The purpose of a peer group analysis is to gain general insights as to the efficiency and effectiveness of a transit system and then to use those insights to guide the more detailed and specific assessment of the system's financial and operating performance. Comparisons of system characteristics and performance are commonplace within peer analysis.

For this analysis, the peer group was selected based on a "likeness factors" as defined by the Florida Transit Information System (FTIS), a data analysis tool that uses National Transit Database (NTD) information. In addition to the peers identified through the FTIS, the City of Tallahassee was also added to the peer group. The peers identified for the analysis are listed in Table 16.

Table 16: CU Peer Group

Peer System	Location	Service Area Population
Rock Island County Metropolitan Mass Transit District	Moline, IL	119,657
Davenport Public Transit	Davenport, IA	98,900
Metropolitan Evansville Transit System	Evansville, IN	122,961
Greater Portland Transit District	Portland, ME	80,391
South Bend Public Transportation Corporation	South Bend, IN	154,346
City of Jackson Transit System	Jackson, MS	196,000
Transfort	Fort Collins, CO	118,652
City Transit Management Company, Inc.	Lubbock, TX	199,564
Metra Transit System	Columbus, GA	230,208
Bloomington-Normal Public Transit System	Bloomington, IL	117,156
Fort Wayne Public Transportation Corporation	Fort Wayne, IN	248,637
Waco Transit System, Inc	Waco, TX	117,241
City of Tallahassee	Tallahassee, FL	162,310

Table 17 contains operating statistics for CU and the selected peer systems for 2009. These operating statistics are the basis for the performance measures included in this analysis.

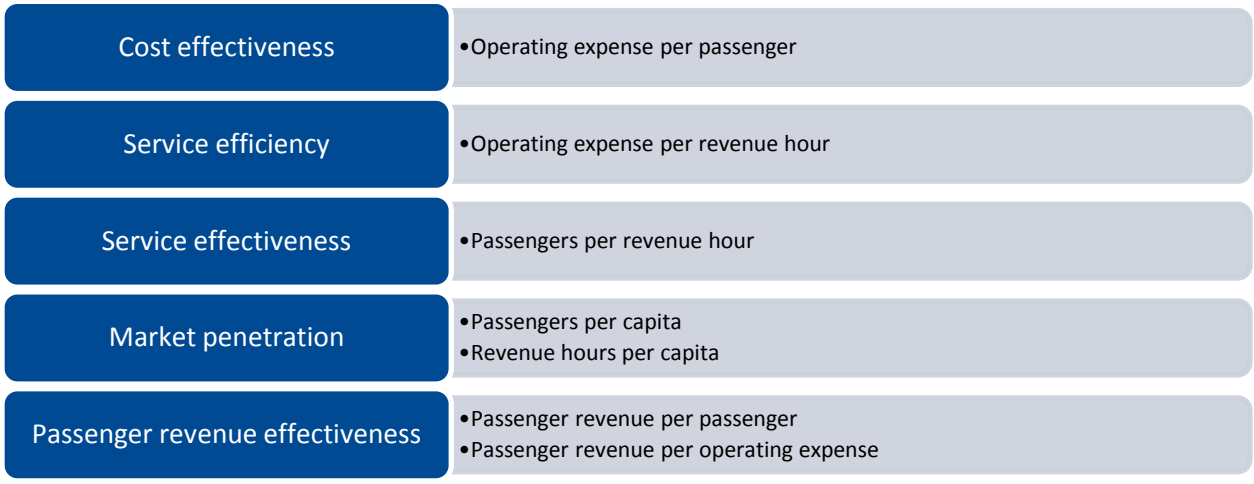
Table 17: 2009 Peer Operating Statistics

Peer	Revenue Hours	Passenger Trips	Operating Expenses	Passenger Revenues
Moline, IL	163,107	2,864,615	$ 13,916,893.00	$ 994,367.00
Davenport, IA	56,683	1,125,511	$ 4,628,333.00	$ 354,757.00
Evansville, IN	94,772	1,831,479	$ 5,144,951.00	$ 954,227.00
Portland, ME	69,872	1,411,842	$ 6,072,227.00	$ 1,452,551.00
South Bend, IN	122,854	2,470,120	$ 8,503,854.00	$ 1,143,827.00
Jackson, MS	64,879	516,721	$ 4,581,660.00	$ 318,295.00
Fort Collins, CO	73,121	1,904,229	$ 6,026,704.00	$ 839,968.00
Lubbock, TX	115,214	2,674,171	$ 7,046,567.00	$ 2,762,000.00
Columbus, GA	60,864	1,150,708	$ 3,493,702.00	$ 910,806.00
Bloomington, IL	87,403	1,609,081	$ 5,254,894.00	$ 911,634.00
Fort Wayne, IN	100,867	1,791,787	$ 9,798,273.00	$ 1,138,601.00
Waco, TX	46,139	636,111	$ 3,320,815.00	$ 459,914.00
Tallahassee, FL	181,869	4,409,041	$ 10,500,430.00	$ 3,793,365.00
National Peer Average	151,233	1,876,570	$ 6,791,484.85	$ 1,233,408.62
CU	76,572	1,458,164	$ 6,858,779.00	$ 858,264.00
% of Average	80%	78%	101%	70%

Performance Measures

The peer analysis is this section compares CU to its peers for five objectives using seven specific measures, as organized in Figure 53.

Figure 53: Performance Objectives and Performance Measures

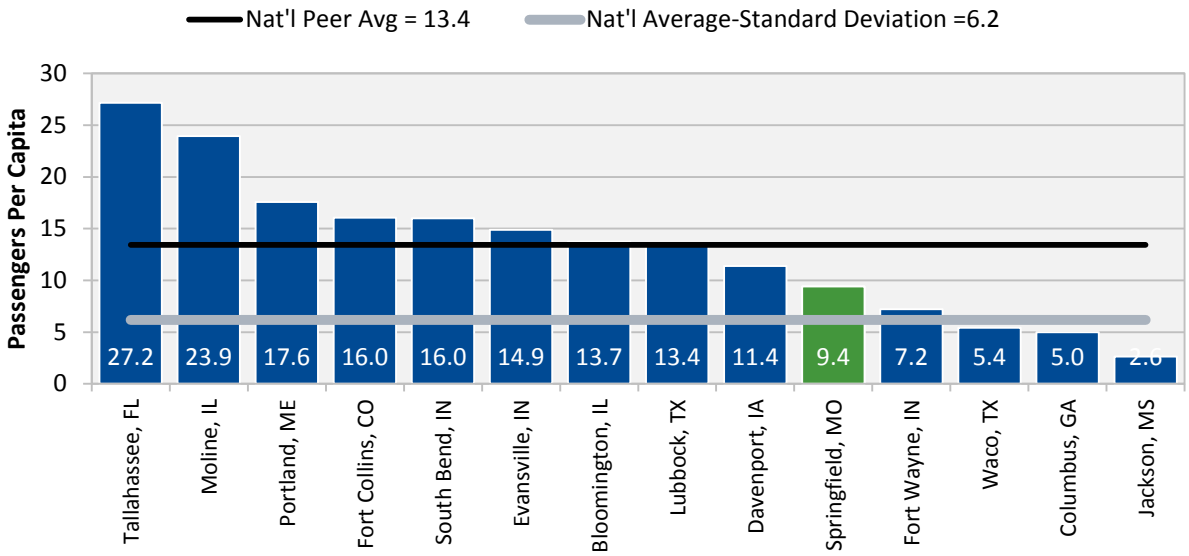


Each measure is used to assess CU's performance compared to the peer average for fiscal year 2009. Performance is considered "satisfactory" within one standard deviation of the peer average (arithmetic mean).

Cost Effectiveness

Cost effectiveness addresses transit use in relation to the level of resources expended. The primary measure for comparison under this area is **operating expense per passenger**. The average operating expense of providing a single passenger trip on CU's fixed routes is $4.70; the national peer average is $4.12. Although CU's operating expense per passenger is slightly above the national peer average, it is still within acceptable range.

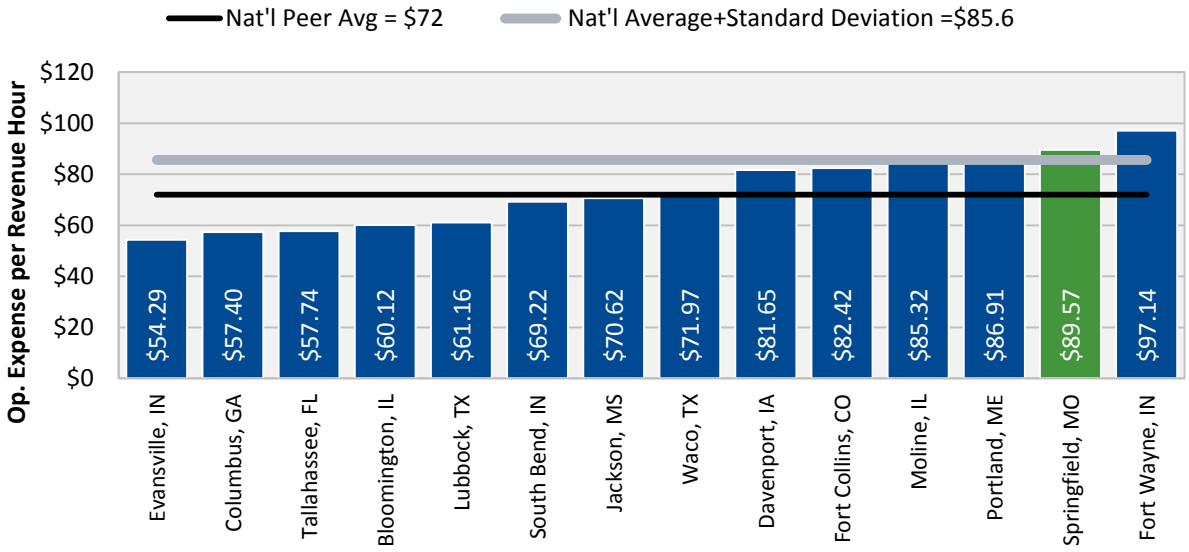
Figure 54: National Peers- Operating Expense per Passenger Trip



Service Efficiency

Service efficiency examines the amount of service produced relative to resources expended. **Operating expense per revenue hour** is the measure used to assess how efficiently a system delivers service. The cost of providing one hour of revenue service on CU's fixed routes is $89.57, higher than the national peer average of $72.00.

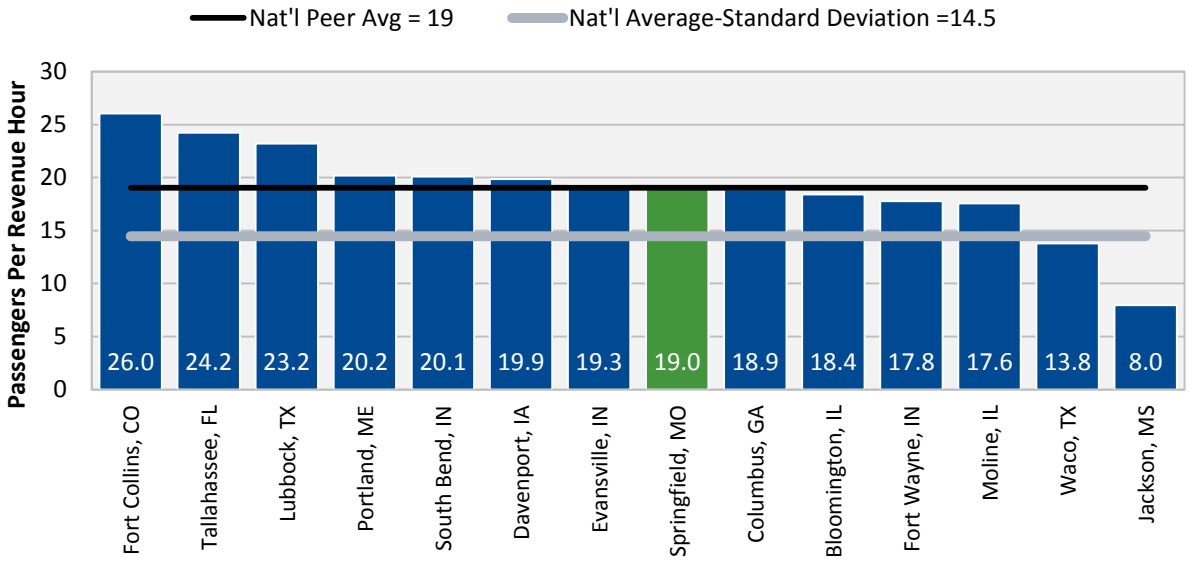
Figure 55: National Peers- Operating Expense per Revenue Hour



Service Effectiveness

Service effectiveness is a measure of the consumption of transit service in relation to the amount of service available. **Passengers per revenue hour** is the measure used to assess service effectiveness. CU carries an average of 19 passengers per hour on its fixed routes. This value matches the national average of passengers per hour.

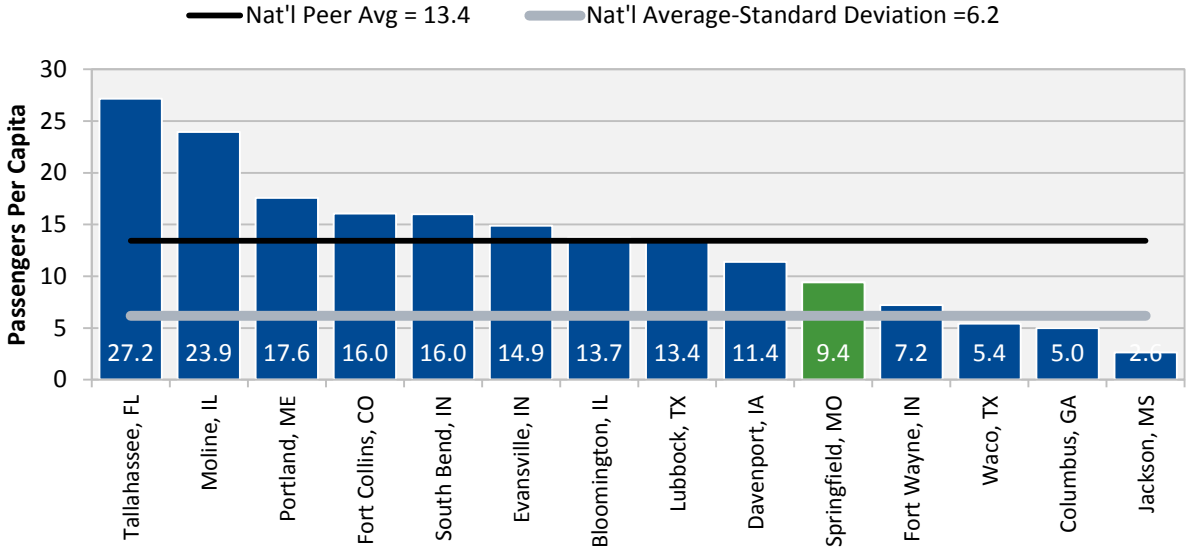
Figure 56: National Peers- Passengers per Revenue Hour



Market Penetration

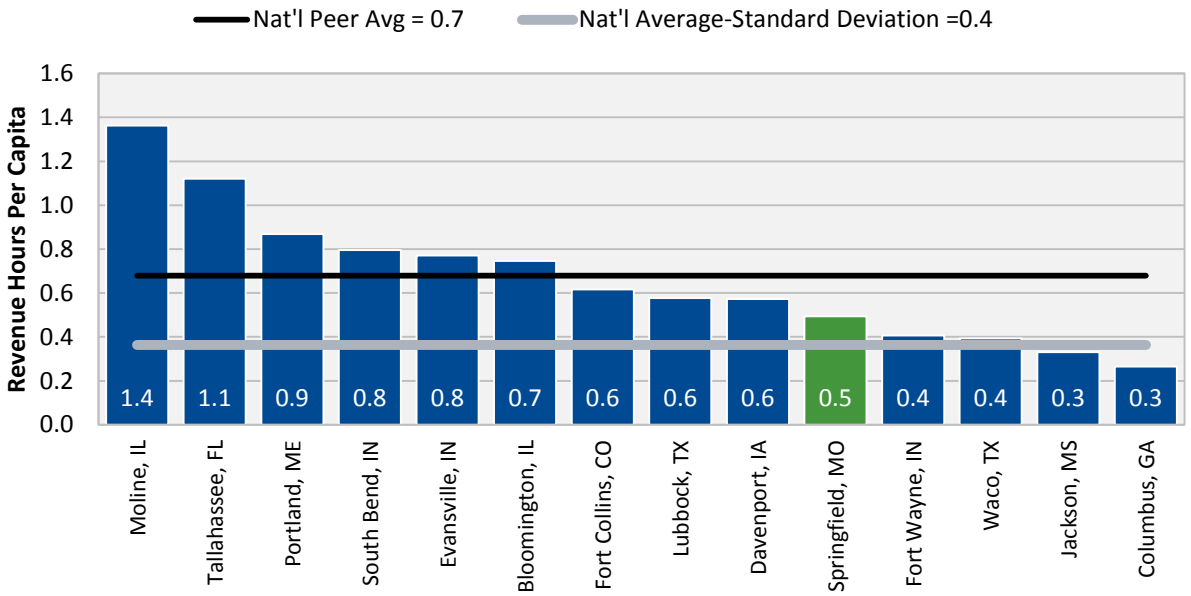
Passengers per capita is a measure of market penetration of current services. In 2009, CU carried 9.4 passengers per capita. This value is lower than the national peer average of 13.4 passengers per capita but within an acceptable range.

Figure 57: National Peers- Passengers per Capita



Revenue hours per capita is the performance measure used to assess service availability. In 2009, CU provided 0.5 revenue hours annually for each person in its service area. This level of service availability is lower than the national peer average of 0.7 revenue hours per capita but within an acceptable range.

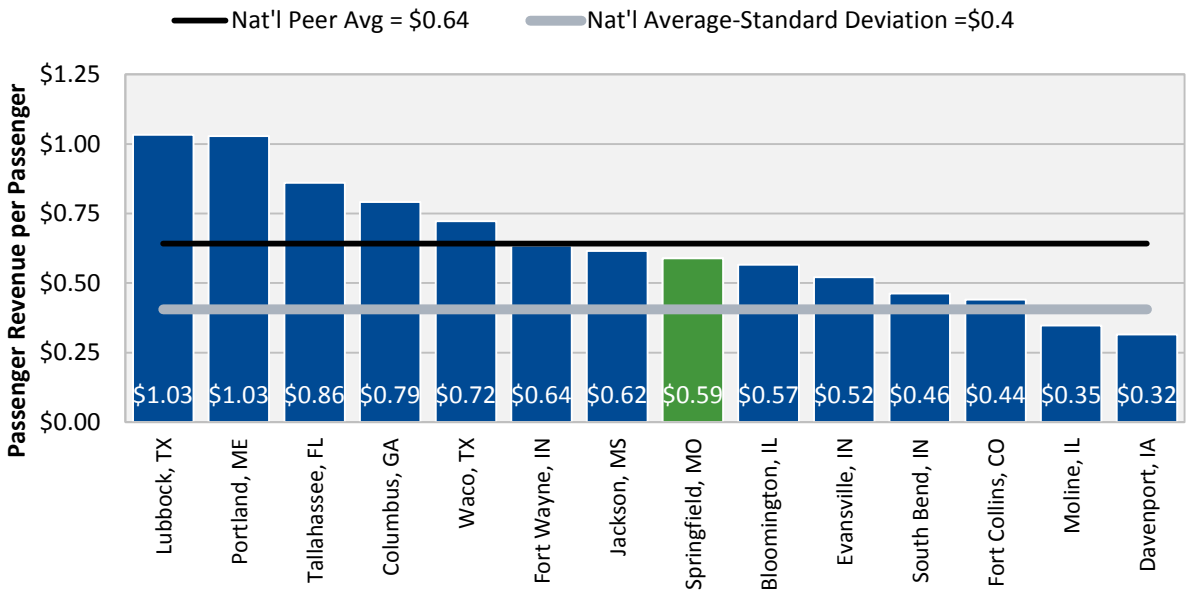
Figure 58: National Peers- Revenue Hours per Capita



Passenger Revenue Effectiveness

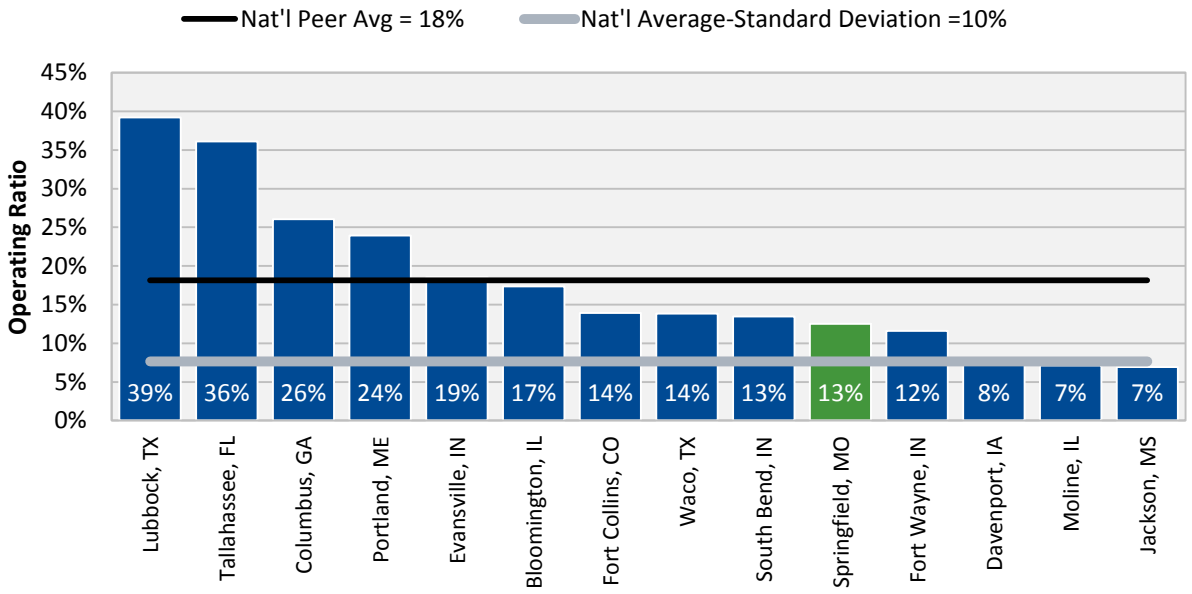
Passenger revenue per passenger, or average fare, measures the amount each passenger is paying to use the service. In 2009, the average CU fixed route passenger paid $0.59 for a ride. This is less than the national peer average of $0.64 per passenger but within an acceptable range.

Figure 59: National Peers- Passenger Revenue per Passenger



Passenger revenue to operating expense measures the level of operating expenses that are recovered through passenger fare payment. This measure is also referred to as the **operating ratio**. In 2009, CU collected 13 cents in passenger revenue for every dollar of operating expense; in other words, the system recovered 13 percent of its operating expense through the farebox. This operating ratio is lower than the national peer average of 18 percent but within an acceptable range.

Figure 60: National Peers- Passenger Revenue per Operating Expense



Ozarks Transportation Organization
Fixed Route Operations Analysis

Part II: Evaluation of Existing System Operation

General System Overview

This part of the report documents system-level observations of operational strengths and deficiencies in the existing City Utilities (CU) transit system. This section also identifies potential route level changes that should be considered to improve overall operations.

The CU transit system in Springfield generally works well. The system operates seven days per week, with a long span of service between 5:45 a.m. and 11:10 p.m. on weekdays, 6:00 a.m. and 11:10 p.m. on Saturdays, and 7:10 a.m. and 11:10 p.m. on Sundays.

The results of the customer on-board survey indicate that in addition to providing many low and moderate income residents access to job opportunities throughout Springfield, the CU transit system also connects people with medical facilities and many social service agencies. Shopping trips are also easily accommodated with the connections between residential locations and commercial areas. Overall, the system is well designed and makes it easy to live in Springfield without an automobile; or, as a family, to have one automobile per household. The system serves areas of the community where there is a large population that is likely to use transit service.

Many minor and some major changes have been made over the years to provide more efficient and effective bus service. The route system is dynamic, with CU management and drivers working to review and improve the system on a regular basis. As route and schedule problems develop, the driver and management cooperation model is able to investigate and solve many service-related problems. In the last three years, there have been 17 route and schedule changes as a result of the close communication between management, drivers, and passengers. CU management also meets with the Missouri Department of Transportation (MoDOT) and the City of Springfield on a regular basis to review transit issues.

CU has established a Driver/Management Fixed Route Committee consisting of managers and drivers who have shown a strong interest in solving route and schedule problems. In the last three years, CU has made 17 changes to the system. Several of these changes have been reviewed and analyzed by the Driver/Management Fixed Route Committee. The result has been minor changes that have made the system as efficient as reasonably possible. The elimination of driveway service at commercial businesses, elimination of some bus stops, and usage of more efficient streets has maximized the efficiency of the current network.

The process and the results are excellent. A Customer Fixed Route Committee also exists and its purpose is to review route change suggestions. However, each committee would benefit from slightly more formal evaluation criteria and it is recommended that CU develop such criteria. Ease of driving, safety, traffic flow, and customer amenities can easily be identified. Any recommendations from this project should be thoroughly reviewed by the Driver/Management Fixed Route Committee, the Passenger Fixed Route Committee, and transit management. In addition, the impact of changes on the individual customer should be quantified.

Current Network Design

CU operates 14 weekday daytime fixed routes in the Springfield area. All of the routes are designed as typical urban fixed routes; there are no express or limited-stop routes. The system is designed to serve three pulse points:

- The primary pulse point, Park Central Transfer Station, located in downtown Springfield serves 10 routes (1-N. Kansas Expressway, 2-E. Dale, 4-E. Central, 5-S. Glenstone, 6-College, 7-S. Campbell, 9-S. Fort, 12-S. National, 13-Nichols and Broadway, and 14-W. Atlantic).
- A smaller pulse point, located near the Walmart Supercenter (East Kearney Street and North Glenstone) in northeast Springfield, serves as a connection point for four routes (2-E. Dale, 8-Norton, 10-Cedarbrook, and 15-E. Kearney). Only Route 2-E. Dale connects with the downtown pulse point.
- A smaller pulse point located near the Battlefield Mall serves routes 5-S. Glenstone, 11-Sunshine, and 12-S. National. Routes 5-S. Glenstone and 12-S. National also connect to the downtown pulse point.

There are several operating efficiencies that are designed into the individual routes as system policy. Many urban systems have buses pull into individual businesses, such as a Walmart or medical facilities. The CU buses generally remain on the street or at a side passenger loading facility that avoids mixing buses with heavy pedestrian movements. Shelters and turnouts are generally provided at these locations, maximizing passenger safety and convenience.

CU has been proactive over the years in adjusting the transit network to better meet customer needs. Some of the changes have been significant, while others have been minor. Changes that have been made in the last three years are summarized in Table 18.

Table 18: Route Changes within the Past Three Years

Route	Changes
Route 1-N. Kansas Expressway	• Extended to Fulbright Springs for a three month trial
Route 5-S. Glenstone	• Rerouted to Weller instead of Fremont on the south end • Afternoon headway was increased from 30 minutes to 20 minutes
Route 6-College	• Same route transfer was created to reduce overall travel time • Same route transfer was moved to Mount Vernon and Scenic and later moved to Grand and Clifton • Moved from Catalpa on Saturdays
Route 7-S Campbell	• Extended to Library Center
Route 8-Norton	• Extended to Expedia • Eliminated service to Aaron's Automotive
Route 9-S. Fort	• Extended west on Republic to Scenic
Route 10-Cedarbrook & Route 15-E. Kearney	• Morning and afternoon headways were reduced from 30 minutes to 60 minutes
Route 11-Sunshine	• Rerouted from Scenic to Golden
Route 12-S. National	• Rerouted to Jefferson instead of Campbell between Powell and Battlefield
Route 14-W. Atlantic	• Rerouted to Calhoun to better serve Drury University
Route 27-Red Route	• Created and modified later to serve Chesterfield Village
Night Shuttle	• Extended to Cox South

The current routes are displayed in Figure 61 through Figure 78.

Figure 61: Route 1- N. Kansas Expressway

Figure 62: Route 2-E. Dale

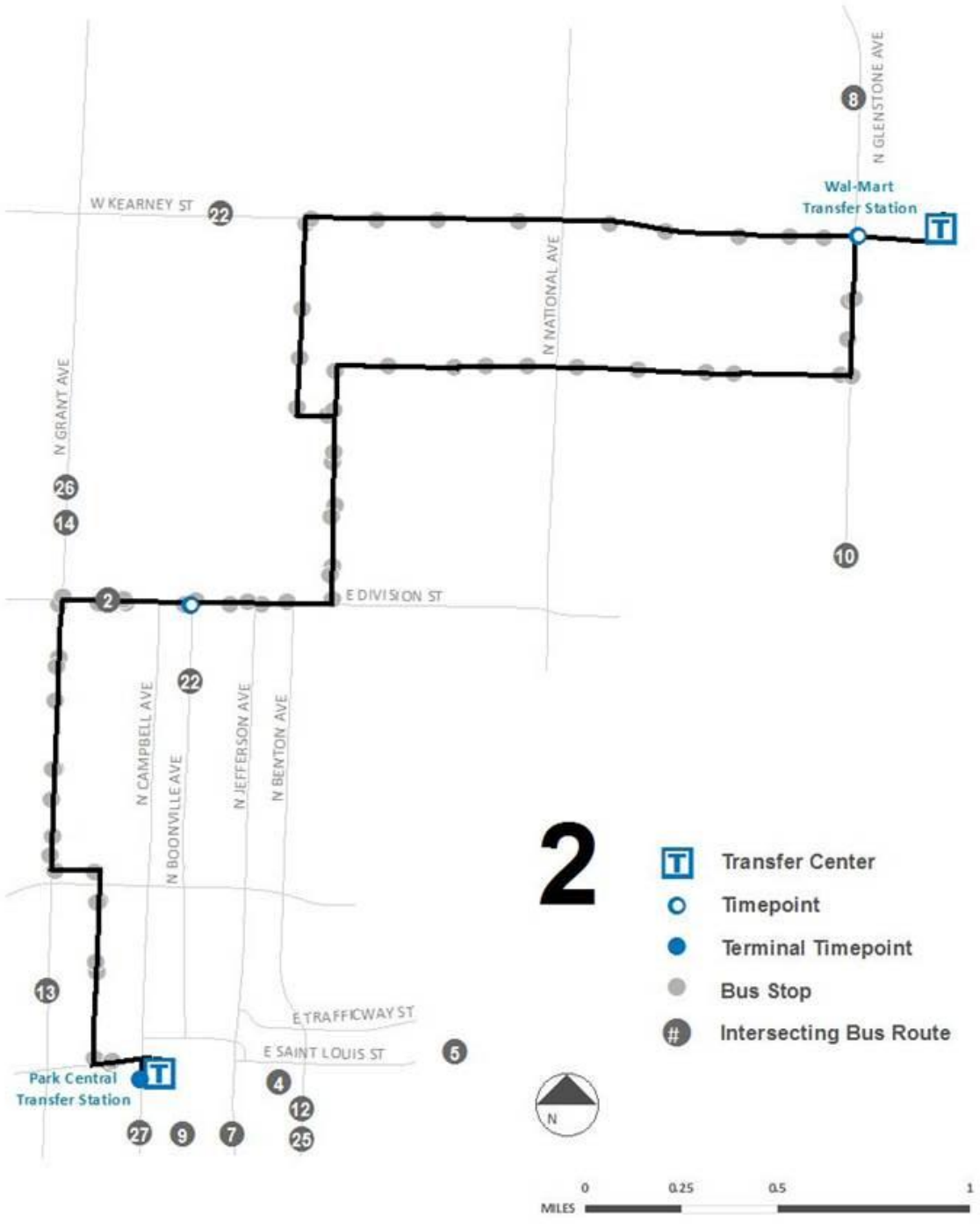


Figure 63: Route 4-E. Central

Figure 64: Route 5-S. Glenstone

Figure 65: Route 6-College

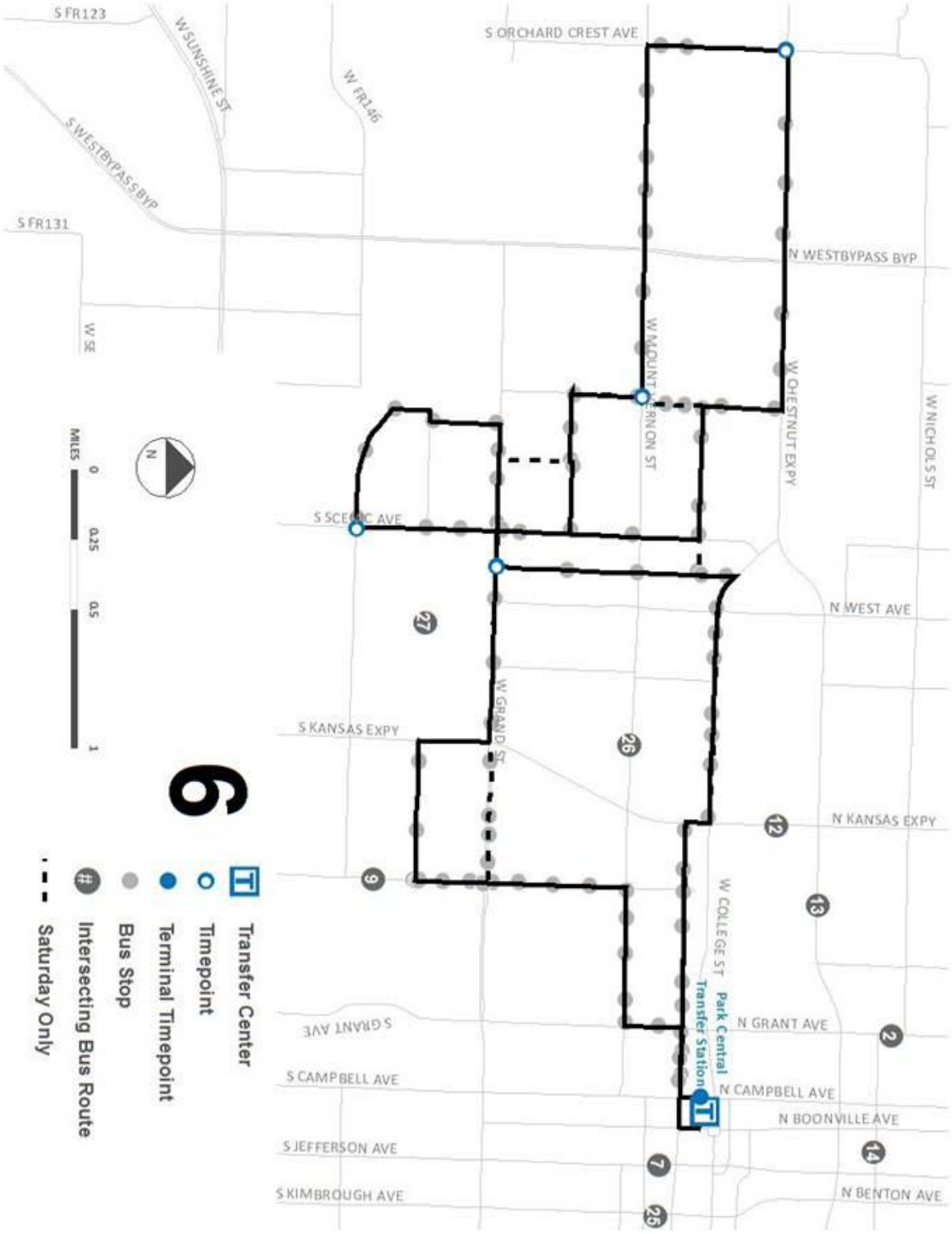


Figure 66: Route 7-Campbell

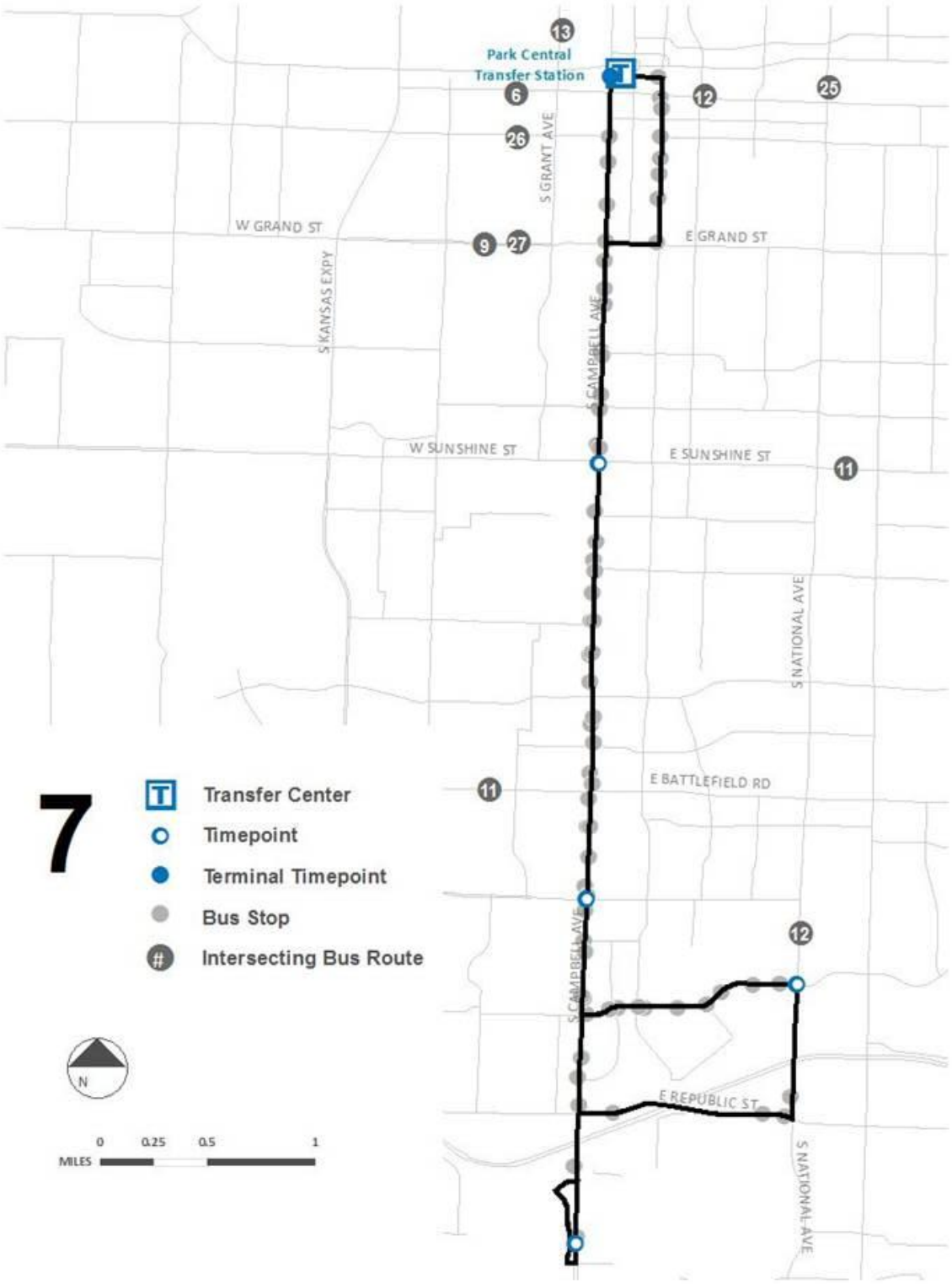


Figure 67: Route 8-Norton

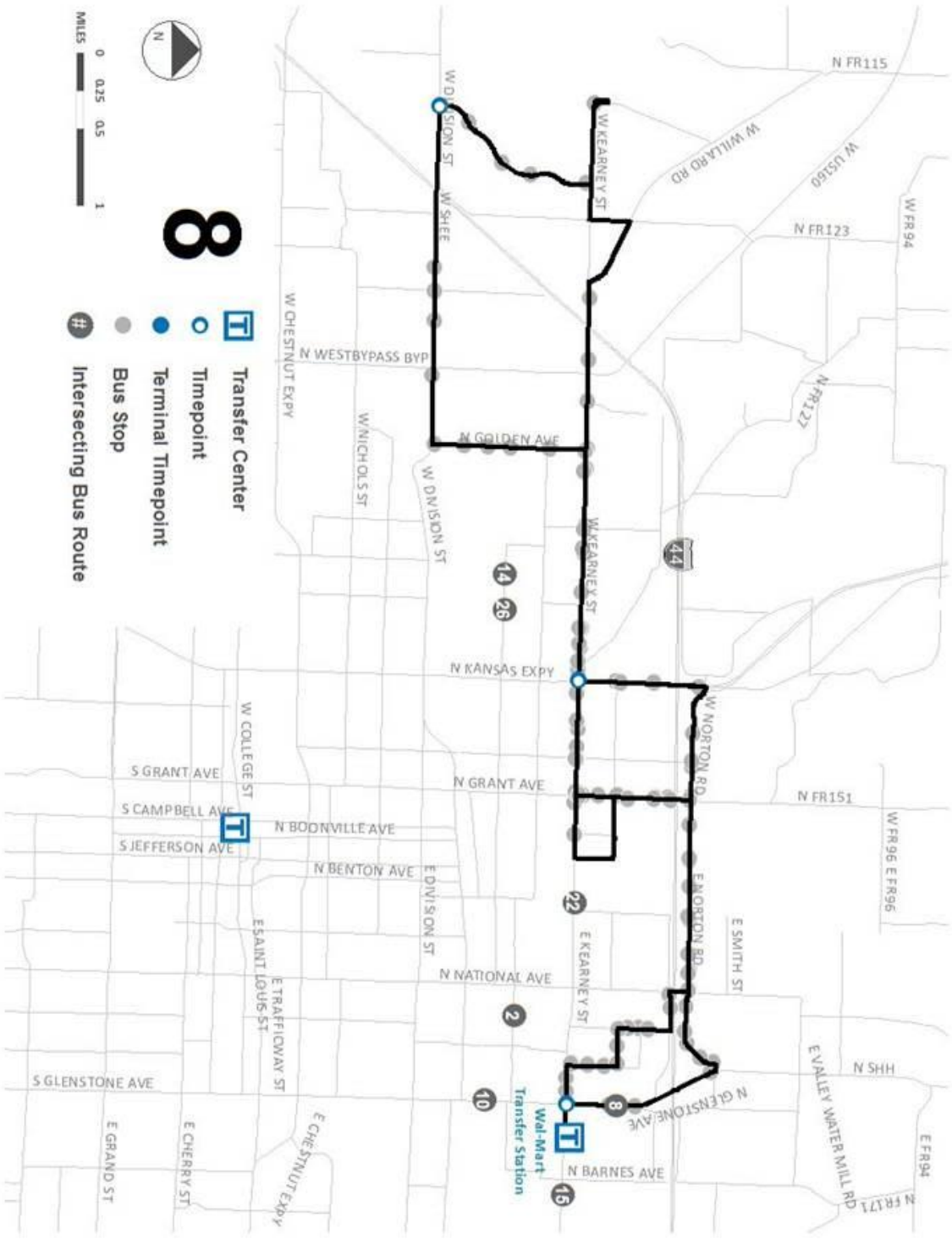


Figure 68: Route 9-S. Fort

Figure 69: Route 10-Cedarbrook

Figure 70: Route 11-Sunshine

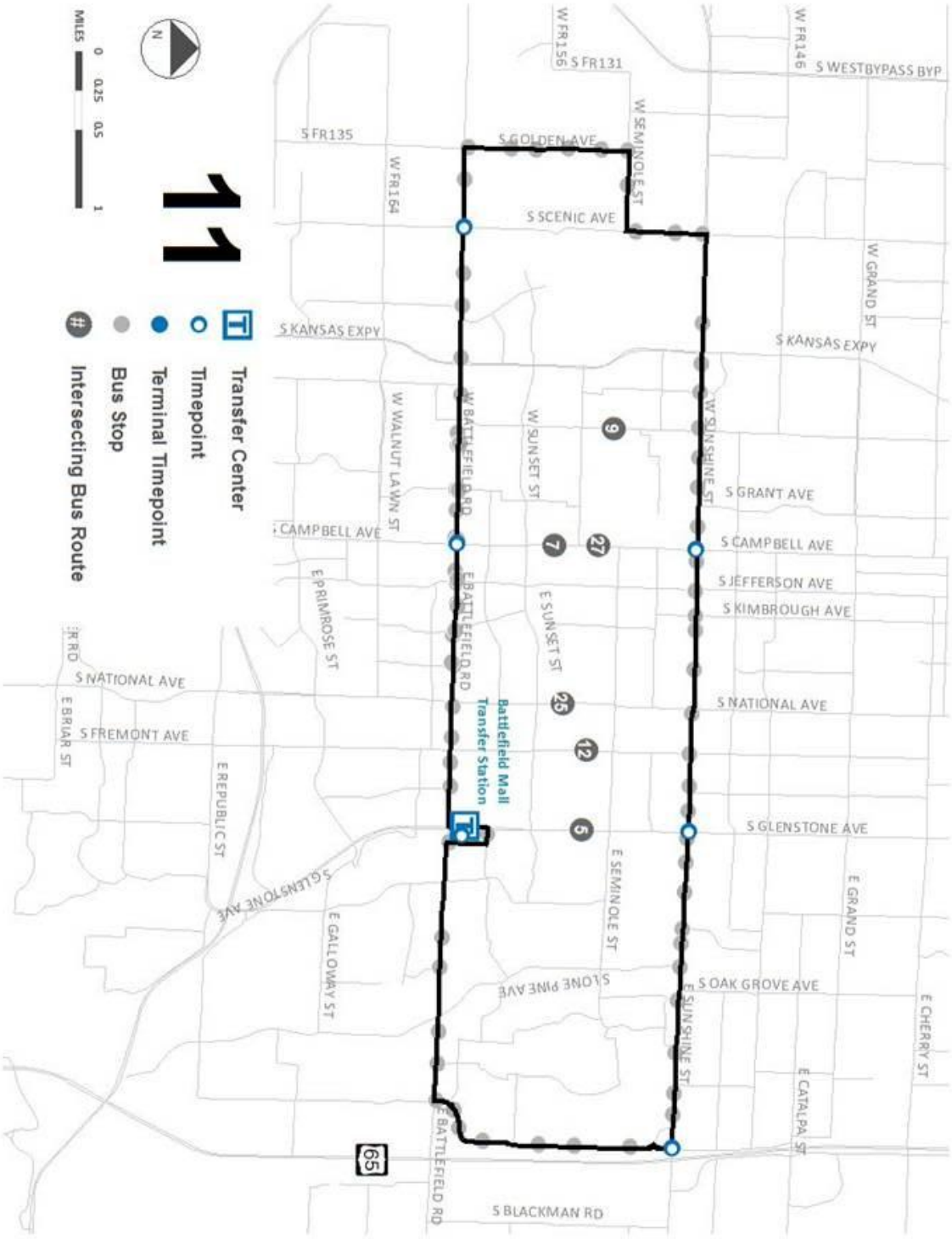


Figure 71: Route 12-S. National

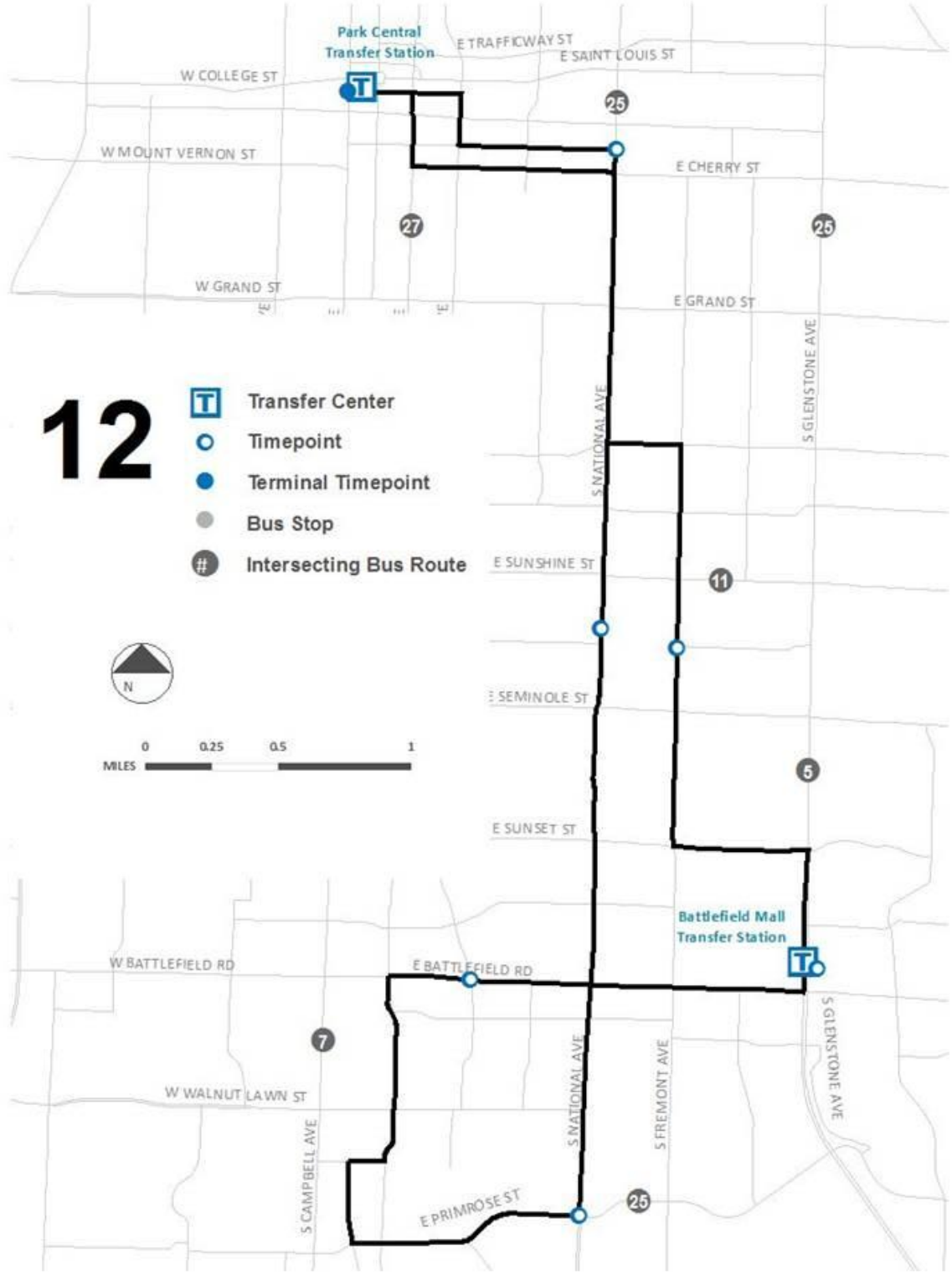


Figure 72: Route 13-Nichols & Broadway

Figure 73: Route 14-W. Atlantic

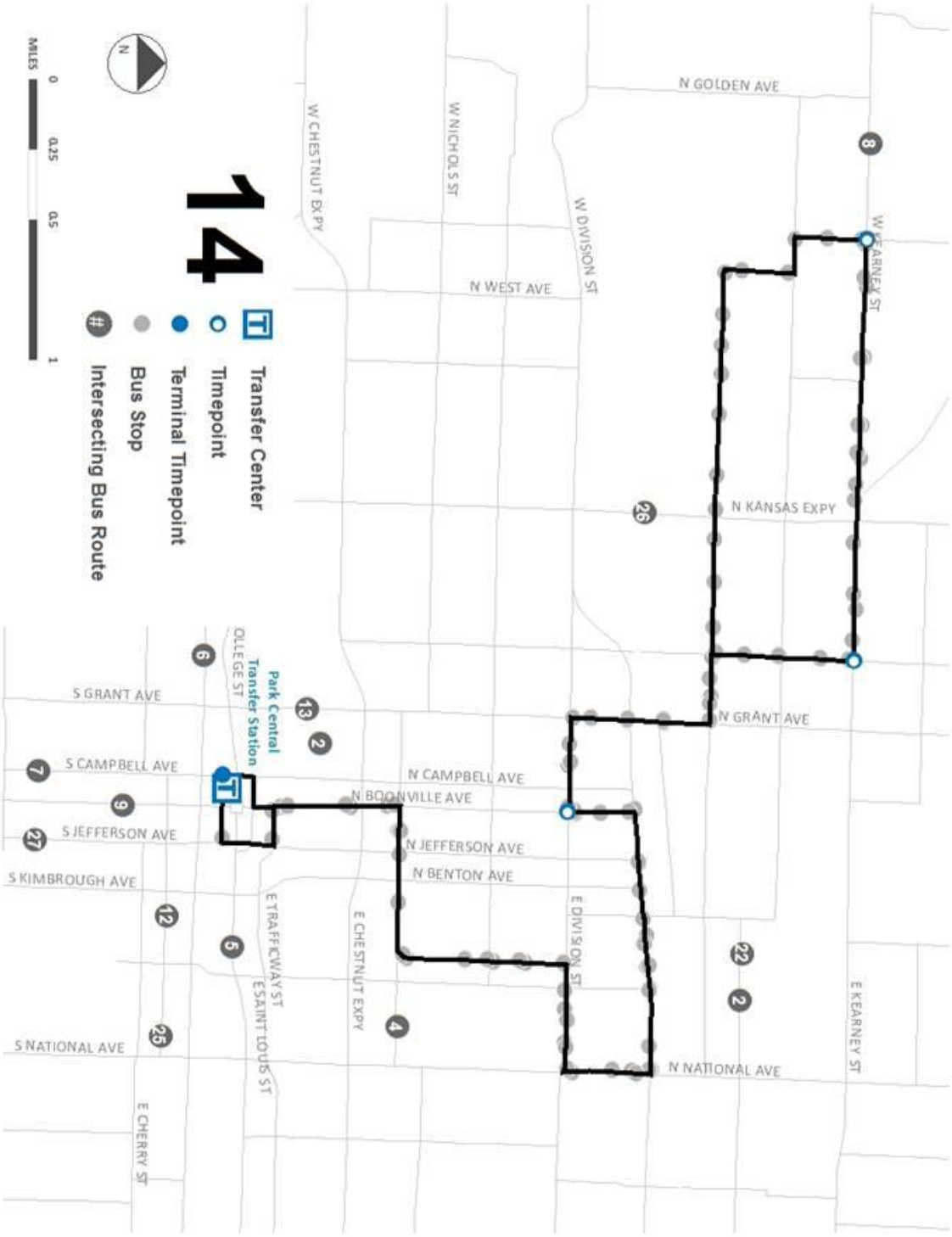


Figure 74: Route 15-E. Kearney

Figure 75: Route 22-Green Route

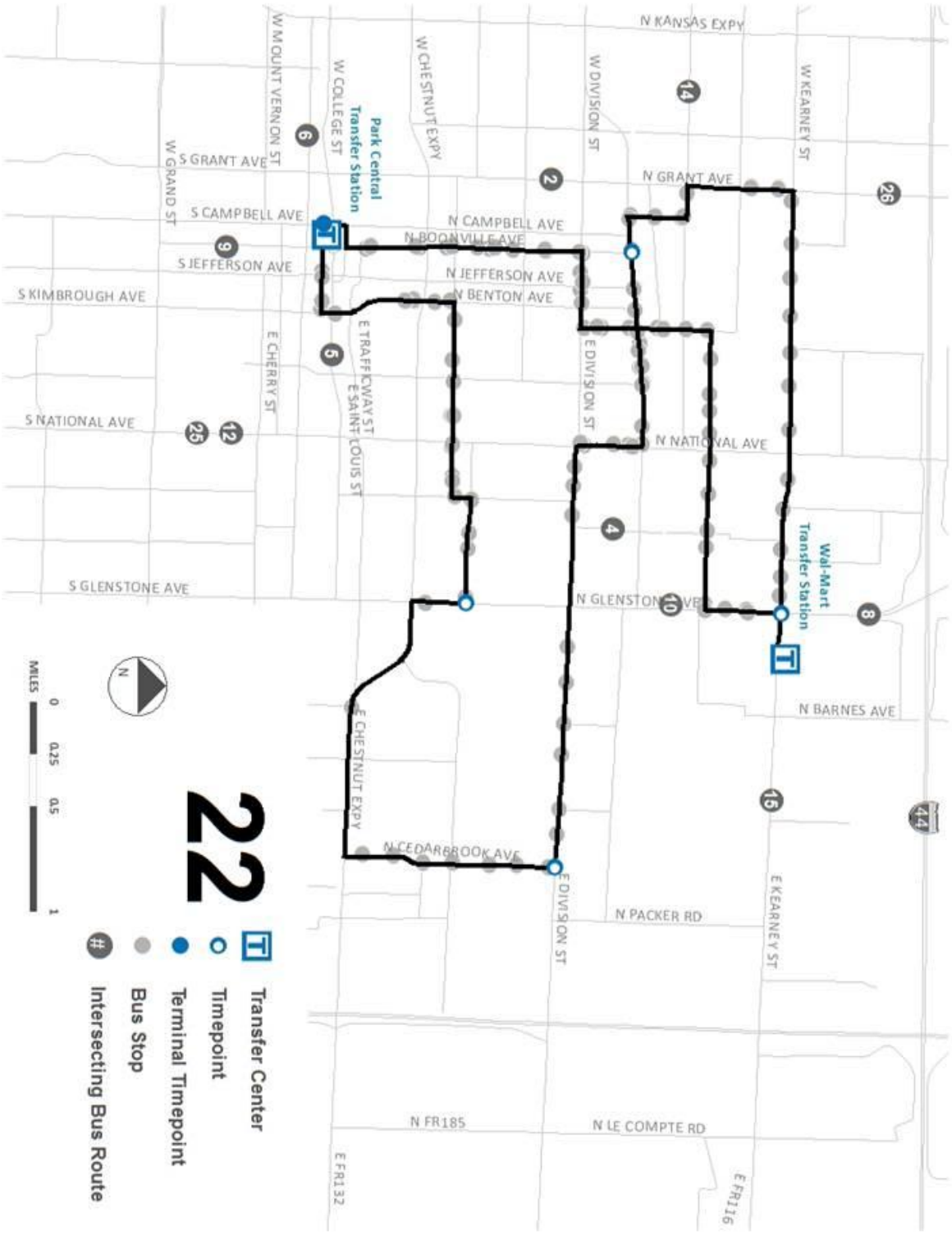


Figure 76: Route 25-Blue Route

Figure 77: Route 26-Black Route

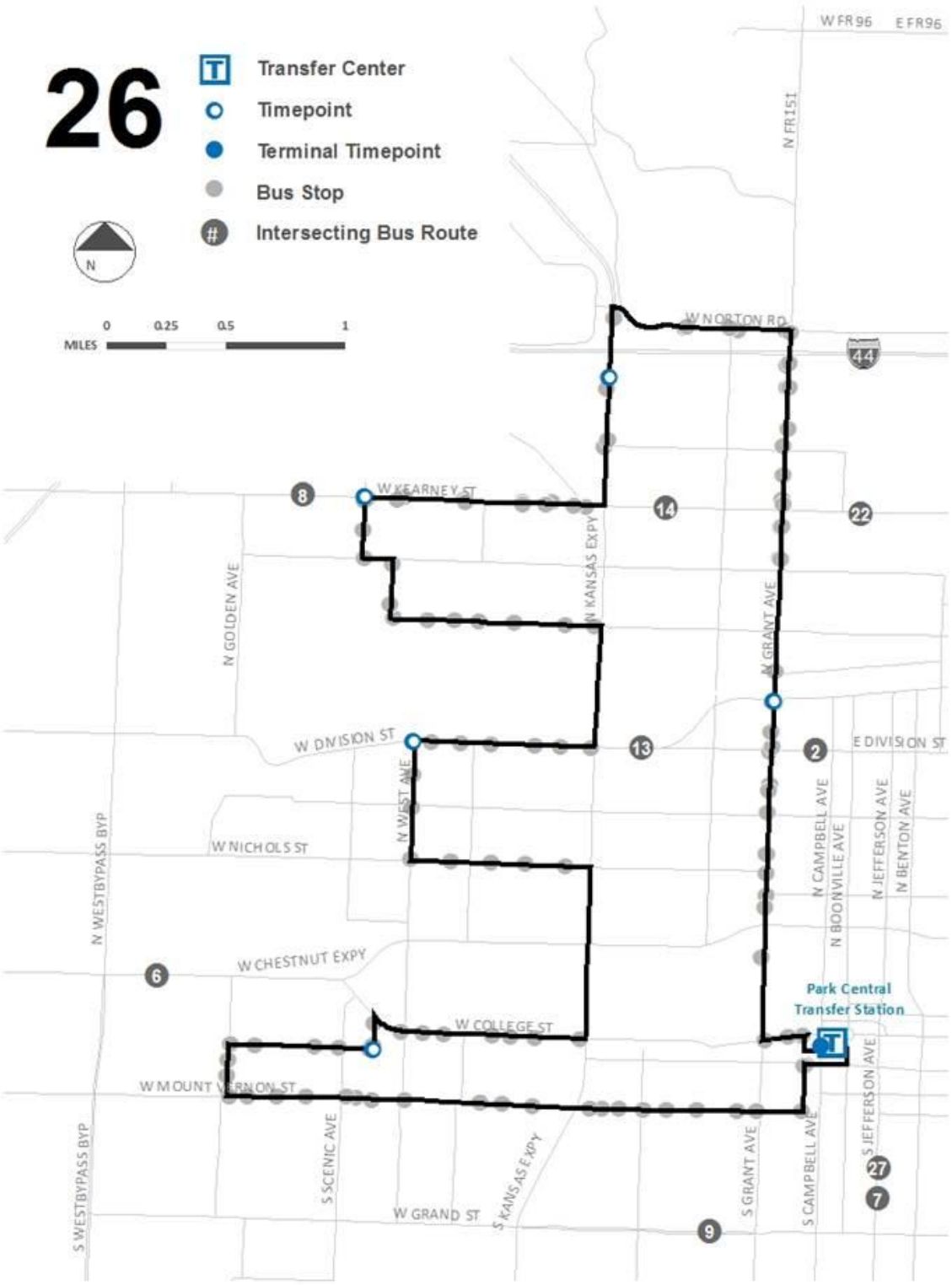
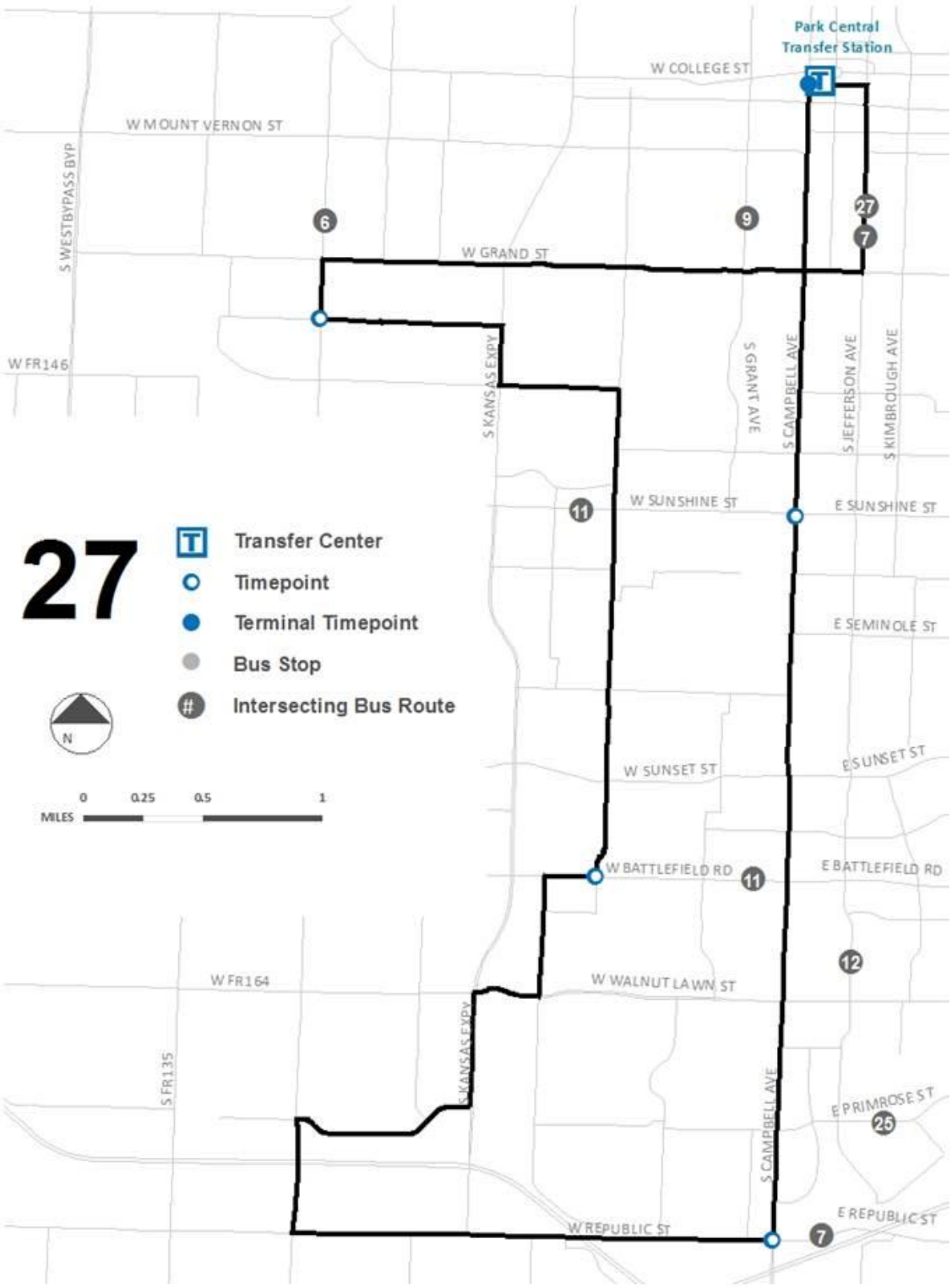


Figure 78: Route 27-Red Route



Current Network No Cost Recommendations

Route observations can be split between north side routes and south side routes, because there are many similar characteristics when routes are grouped in this manner.

Table 19: North/South Side Routes

North Side Routes	South Side Routes
1- N. Kansas Expressway	5- S. Glenstone
2- E. Dale	6- College
4- E. Central	7- S. Campbell
8- Norton	9- S. Fort
10- Cedarbrook	11- Sunshine
13- Nichols & Broadway	12- S. National
14- W. Atlantic	
15- E. Kearney	

North Side Route Options

The north side routes, which primarily serve residential areas, are more circuitous with many turns creating long travel times. The three strongest north side routes in terms of total ridership are 1-N. Kansas Expressway, 2-E. Dale, and 14-W. Atlantic. The rest of the north side routes generally have lower ridership and productivity levels.

The north side routes are long established and well-used by the local population. However, the disadvantage of the current route structure is that it is not attractive to new customers. While the south side routes provide competitively fast travel times, the north side routes negate some of the efficiency of the south side. In general, the strengths and weaknesses of the north side routes are described in the following sections.

Strengths

- Good coverage of residential areas
- Safe low-volume streets
- Good sidewalk infrastructure within walking distance to many bus stops
- High transit-dependent population areas served with 30-minute intervals

Weaknesses

- Long travel times on some routes
- Lack of bi-directional travel on many route segments
- 60-minute intervals on several routes
- Complete sidewalk network not in place

Routes 4-E. Central, 8-Norton, 10-Cedarbrook, and 15-E. Kearney are four of the five weakest routes in the CU system. These routes; however, serve an important function of taking people to and from their residences to make connections with south side buses which provide service to places of employment. Additionally, some trips on north side routes remain solely on the north side. The N. Kansas Expressway Walmart and the Kearney/Glenstone Walmart also serve as anchors for the route network generating

many work and shopping trips that are totally on the north side and do not require a transfer downtown.

Any potential changes to the north side route network should be carefully evaluated as the current route network is reasonably effective. The changes presented below will reduce travel times for some customers, but may require other customers to walk a longer distance to/from the bus stop nearest their residence. The recommended changes will result in a more orderly network with some upside growth potential. The current route configuration has very little growth potential. The proposed changes are:

- Combine current Route 4-E. Central and Route 10-Cedarbrook
- Combine current Route 13-Nichols and Broadway with the west half of Route 8-Norton
- Combine current Route 15-E. Kearney with the east half of Route 8-Norton

Currently, three buses are assigned to these routes during peak times. Under the proposed change, three buses will still be required. Segments of the routes would change and would be routes 4-E. Central/10-Cedarbrook; 8-East Norton/15-E. Kearney; and 8-West Norton/13-Nichols. Because there is a change in route segments and no change in equipment and drivers assigned to the service, it must be implemented as an entire package. It cannot be implemented partially due to scheduling logistics.

Routes 8-Norton, 10-Cedarbrook, 15-E. Kearney, and 13-Nichols currently operate at 60 minute headways at all times. They are proposed to continue to operate at 60 minute intervals with no change in current vehicle requirements.

These changes will result in longer rides for Route 4 customers that board beyond Fremont & Division and for Route 13 customers beyond Division and Nichols (an increase from 15 minutes to 45 minutes).

Route 4-E. Central and Route 10-Cedarbrook Combination

In 1999, the current Route 10-Cedarbrook was the southern half of Route 8-Norton. Service focused on the northeast Walmart and was provided at 60 minute headways. Frequency was improved to 30 minute headways at peak times in 2002 when the Cedarbrook segment was assigned to Route 15-E. Kearney. In 2007, the current Route 10-Cedarbrook was created. It currently operates at 60 minute intervals, except for one additional trip in the morning at 7:00 a.m.

Route 10-Cedarbrook is an isolated route that connects with other routes at the northeast Walmart at Kearney/Glenstone. It has the second lowest (17th out of 18) annual ridership in the system. The low ridership on this route can be attributed to current land uses that don't generate much transit demand, hourly headways, and the multiple transfers required to reach many destinations in the route network.

This route makes a convenient connection with Route 5-S. Glenstone at Cherry/Glenstone, but the tight scheduling often causes passengers to force their way through moving traffic to make the connection with the tightly scheduled Route 5-S. Glenstone buses. Transfers with Route 2-E. Dale at Walmart are made in a safe location, but the routing is circuitous for passengers who desire to go downtown. Passengers boarding on Cedarbrook can also use Route 5-S. Glenstone to get to downtown.

While this route provides a convenient one seat ride to Walmart, passengers need to transfer to reach all other destinations in Springfield. For these customers, a three seat ride, Route 10-Cedarbrook, then Route 2-E. Dale to get to downtown, and then a third bus to reach their final destination is common.

Proposed Changes

In this proposed alternative, buses would operate from Park Central Transfer Station via Route 4-E. Central to Division/Glenstone, then via Route 10-Cedarbrook to Pythian/Glenstone, then via Route 4-E. Central to downtown, as shown in Figure 79. The mileage for this route configuration is 11.3 miles and can be accomplished easily within a 60 minute cycle.

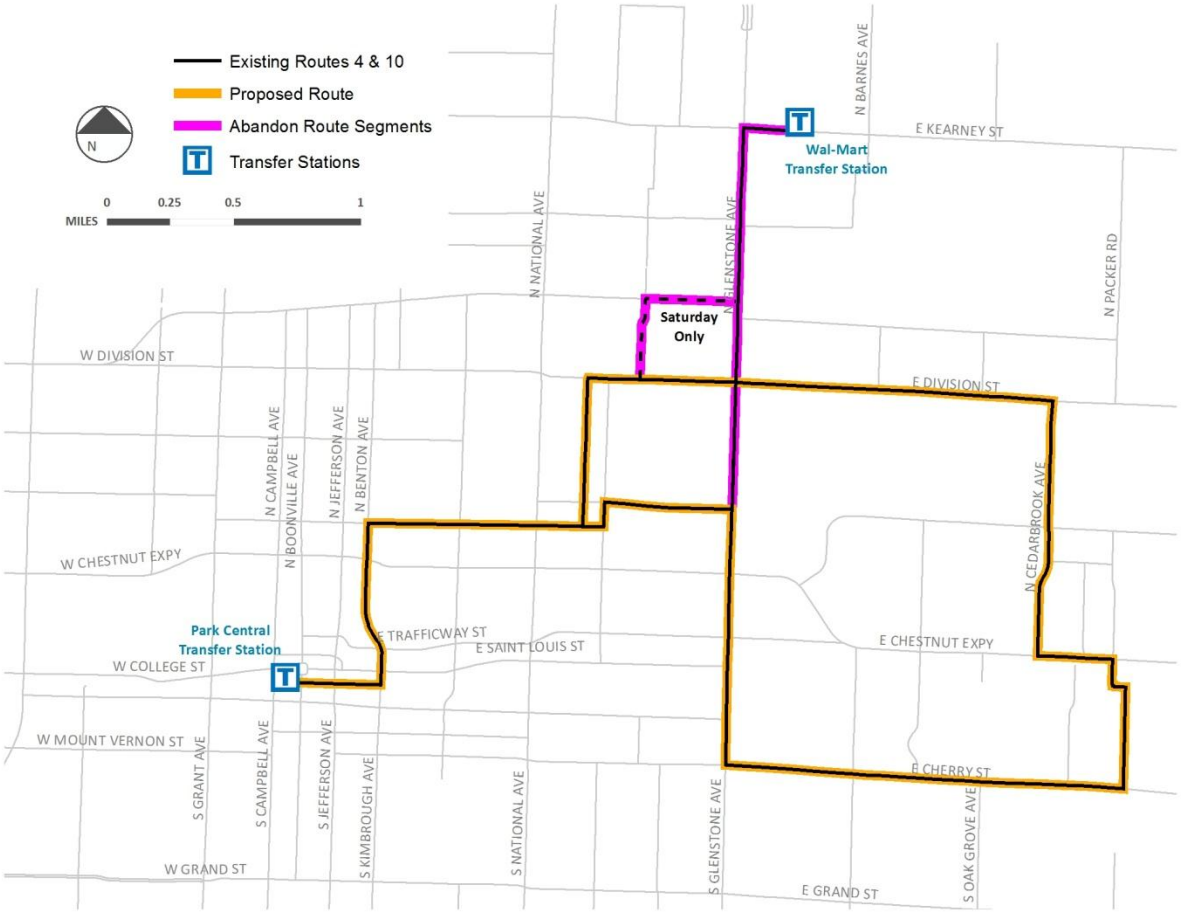
The advantages to this alternative are:

- Direct service from Cedarbrook area to downtown for connections to ten other routes
- Continue to make connections with Route 5-S. Glenstone for trips to Battlefield Mall area

The disadvantages to this alternative are:

- No direct service to Northeast Walmart
- No direct connections with Route 8-Norton and Route 15-E. Kearney
- The fourth change in routing in 14 years
- No service on Glenstone between Division and Kearney

Figure 79: Route 4-E. Central and Route 10-Cedarbrook Combination



Combine Route 13-Nichols and Broadway with West Half of Route 8-Norton

The west half of Route 8-Norton (west of Kearney/Broadway) was added to the CU system in 2002, and has been modified in attempts to increase ridership. The current west end of Route 8-Norton makes connections with routes 1-N. Kansas Expressway, 2-E. Dale, 10-Cedarbrook, 14-W. Atlantic, and 15-E. Kearney. Transfers are scheduled to minimize wait time.

Proposed Changes

By connecting the west end of Route 8-Norton with Route 13-Nichols and Broadway as shown in Figure 80, passengers going to the employment centers in northwest Springfield will have a convenient one seat ride to Park Central Transfer Station where connections can be made with ten routes.

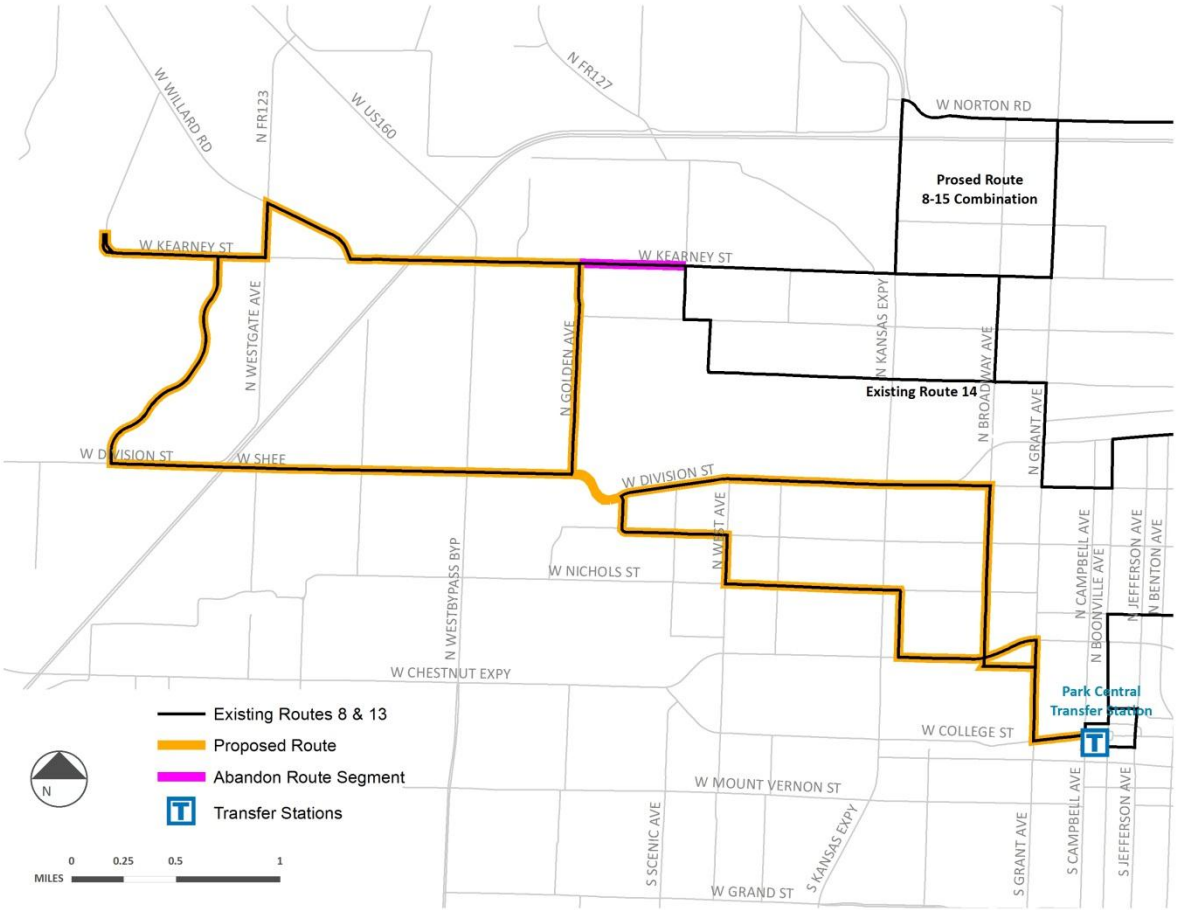
The advantages of combining the west end of this alternative are:

- Direct, one seat ride, connections with ten routes at Park Central Transfer Station
- Combines two weak routes

The disadvantages of combining these routes are:

- Some passengers that are currently transferring in the northern sections of the system may have to go downtown to transfer
- No service on Kearney between Golden and Fulbright

Figure 80: Route 13-Nichols and Broadway with West Half of Route 8- Norton Combination



Combine Route 15-E. Kearney with East Half of Route 8-Norton

Route 15-E. Kearney was created in 1999 with 30 minute headways all day and was originally defined as Route 10. In 2002, it was combined with the current Route 10-Cedarbrook and operated at 30 minute headways in peak periods and 60 minute headways in the midday. It has retained its current configuration and headway until the present time. Route 15-E. Kearney has the lowest total ridership (approximately 12,000 passengers annually) and the lowest productivity (6.6 passengers per hour).

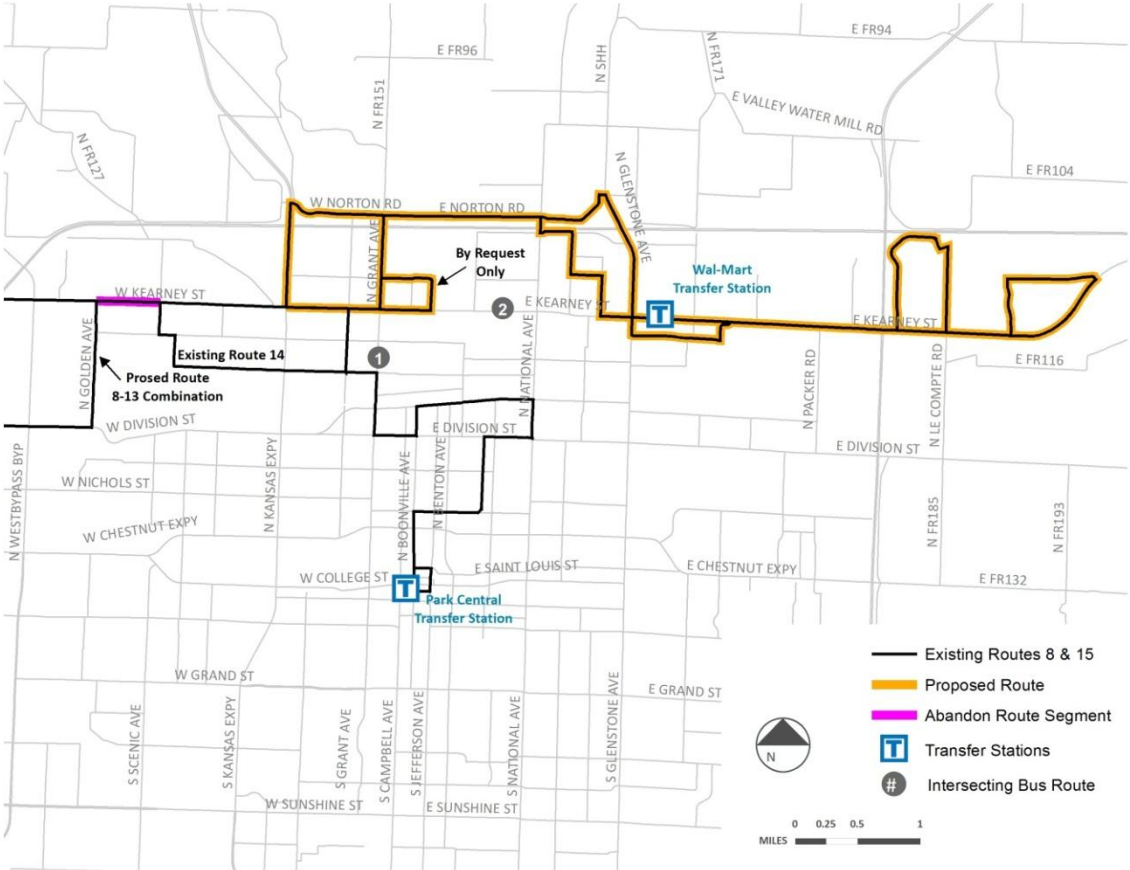
The east half of current Route 8-Norton has been mostly unchanged since 1998. The terminal at Broadway/Kearney was changed to a loop via Broadway and Grant in 2002 and further extended to a loop via Kansas Expressway and Grant in 2005. Service frequency on this route was 60 minutes all day in 1999. Peak period headways of 30 minutes were introduced in 2002, and were later reduced to 60 minute intervals in 2005, except for one additional trip at 6:30 a.m.

Proposed Changes

The proposed service change is minimal for the east half of Route 8-Norton. The 2005 loop terminal via the Kansas Expressway and Grant will be re-established as shown in Figure 81.

Route 15-E. Kearney will retain its current route configuration and operate at 60 minute headways all day.

Figure 81: Route 15-E. Kearney with East Half of Route 8- Norton Combination



The advantages of combining these routes are:

- Continuation of same level of service with no significant change in travel times or connections for current passengers
- Provides east-west route in far north portion of the service area

The disadvantages of combining these routes are:

- Schedule times may vary up to 30 minutes depending on final schedule

North Side Route Recommendations Summary

CU staff and board should be commended for the various changes in service in the far north area of Springfield in an attempt to expand the transit market. Three peak vehicles are assigned to serve routes 8-Norton, 10-Cedarbrook/15-E. Kearney, and 4-E. Central/13-Nichols during peak times. Several route variations have been tried with limited success. This can be attributed to the auto-centric nature of this area.

The stronger north side routes, 1-N. Kansas Expressway, 2-E. Dale, and 14-W. Atlantic, have 30 minute headways and routing has not changed significantly in the last decade. These three routes are the stable core of the north side and carry 71 percent of the total ridership on the north side.

The proposed changes are another variation that will have some minor positive impact on total ridership. Moving buses from the weak sections of Route 8-Norton and Route 15-E. Kearney will have minimal impact on the total ridership.

Connecting Route 10-Cedarbrook and the west end of Route 8-Norton with Park Central Transfer Station may make those services more attractive to current and potential passengers. Service will continue to be provided for those passengers who rely on CU Transit.

It is recommended that the services be changed if there is no significant public opposition to the changes, but expectations should be low. There will not be a large increase in ridership. A 10 percent gain in total trips on the modified routes within two years would be considered extremely successful.

South Side Route Options

The south side routes are significantly different than the north side routes in their design and operation. The south side routes are linear with relatively fast travel times between points along the route. They are logically aligned along high-travel corridors with the north end of the routes at the Park Central Transfer Station. At the far south end, there is some duplication of routing. Route 11-Sunshine is an anomaly compared to all other routes because it operates in a circular one-way loop. In general, the strengths and weaknesses of the south side routes are described in the following sections.

Strengths

- Relatively fast travel times
- Aligned along high-volume travel corridors
- High job opportunity volume near routes
- Good shelter/bench density

Weaknesses

- Areas with weak sidewalk infrastructure on far south end

- Long pedestrian distances from south side residences to bus stops
- Some turnouts delay bus return to traffic flow
- Dangerous pedestrian crossings on five-lane high-capacity streets

While the north side routes tend to circulate through neighborhoods, most of the south side routes are relatively direct and serve high volume transportation corridors. This streamline design with minimal turns and minimal front door service to business or social agencies makes them very effective in connecting the abundance of jobs on the south side with the residential areas on the north side.

The weakness of the south side routes is that residential areas are generally separated by a commercial strip from the bus route. On the far south side, traffic signal spacing is wide, making safe crossings of high speed arterial streets somewhat risky.

On the near south side, residential areas are close to the bus routes, and have an adequate sidewalk network in good condition. It appears that transit markets on the south side are connecting residences of the near south side with jobs on the far south side, similar to the north side residential connections.

On the far south side, most of the traffic generation is to and from businesses with relatively low residential traffic generation. To reach the residential areas on the far south side, significant new investments in residential routes would be required.

Service reliability and schedule adherence is a problem in the afternoon schedules. Morning trips generally run close to schedule, but as traffic volumes increase, the afternoon buses are often late. Additional resources are needed to improve schedule adherence. There are no “no cost” options available to solve the reliability issues with south side routes.

South Side Recommendations

No “no cost” recommendations for south side routes were identified.

Bus Stops

There are 877 bus stops in the CU system, the majority of which are marked. Bus turnouts with benches and shelters are provided at a high number of locations compared to many other transit systems; however, some benches are in poor condition with damaged seats. A good sidewalk network throughout a large portion of the system provides access to bus stops for pedestrians and passengers in wheelchairs.

Bus Stop Spacing

There is a mix of far-side, mid-block, and near-side stops. Transit Cooperative Research Program (TCRP) Report 19 guidelines state that stop spacing should be approximately:

- 600 feet in Central Business Districts
- 750 feet in urban areas
- 1,000 feet in suburban areas

CU bus stop spacing on some routes slightly exceeds the recommended TCRP Report 19 guidelines, most notably on routes 6, 10, 13, and 15. The north-side routes, except parts of Route 8-Norton and Route 15-E. Kearney are generally considered urban routes. The south-side routes have an urban character in areas generally north of Battlefield Road and suburban character on the south ends of the routes. Table 20 shows the average distance between stops and the route types.

Table 20: Fixed Route Bus Stop Spacing

Route	Stops/Mile	Average Distance Between Stops (feet)	TCRP Recommended Distance (feet)	Route Type
1	7.3	724	750	Urban
2	7.0	754	750	Urban
4	6.6	800	750	Urban
5	4.8	1100	750-1000	Urban/Suburban
6	6.0	880	750	Urban
7	5.2	1015	750-1000	Urban/Suburban
8	4.9	1078	750-1000	Urban/Suburban
9	6.8	776	750-1000	Urban/Suburban
10	5.6	943	750	Urban
11	4.9	1078	750-1000	Urban/Suburban
12	5.9	895	750-1000	Urban/Suburban
13	6.2	852	750	Urban
14	7.3	723	750	Urban
15	3.0	1760	750-1000	Urban/Suburban

Route 15-E. Kearney exceeds the TCRP recommended spacing more than any other route. Route 15-E. Kearney operates on high-speed/high-traffic volume streets and provides stops near entrances to factories in the service area. Additional stops may improve passenger access, but careful analysis of passenger needs and traffic safety should be conducted to determine if stop spacing is adequate.

Drivers and management are trying to find every possible method to keep buses on time. The elimination of bus stops reduces the total number of stops and allows for higher average speeds. The

process of minimizing bus stops and avoiding front-door service has made the system as efficient as possible; however, continued elimination of bus stops will have a negative impact on passenger access.

Some CU employees have suggested eliminating more bus stops to improve schedule adherence. The current stop spacing is adequate and eliminating more stops would impede passenger access to and from buses. It is not recommended to eliminate large numbers of stops to improve schedule adherence. Traffic volumes may continue to increase and eliminating stops is a short-term solution to a long-term problem. Providing adequate cycle times in the schedule would address the short-term problem and allow for continued passenger growth and increased traffic volumes.

Recommendations:

It is recommended that CU use extreme caution when eliminating more bus stops. Consideration must be given to walking distances, safe pedestrian access, shelter locations and use, land uses, and land use changes, as well as traffic patterns before more stops are removed. Access to commercial activity and employment opportunities must also be carefully evaluated. Route reliability on residential and collector streets is generally not affected by bus stops when they are properly spaced. Most of the residential bus stop spacing is adequate and appropriate.

Bus Stop Locations

Some bus stop locations are not optimally located to serve passengers and to keep the overall system running smoothly. Far-side stops are generally safer for passengers who need to cross the roadway to reach their destination. They are also usually safer and quicker for a bus moving from a turnout back into the traffic lane, as there is usually a gap in traffic after a signalized intersection. Far-side stops with turnouts also minimize traffic flow interruptions, especially when there is a passenger who requires extra time when boarding or alighting. Consideration should be given to move some near-side stops to far-side locations.

Figure 82: Bus with Rear Roof Turn Signals

A primary issue drivers have is the inability to move back into traffic from turnouts. While turnouts provide a safer pedestrian environment for passengers, they also require additional travel time for the buses on route. Some drivers indicated that they do not use the turnouts during heavy traffic times when they are behind schedule. This causes confusion for the passengers and negates the traffic flow benefits of the turnouts. The Driver Fixed Route Committee is the appropriate forum to address other problematic bus stop locations.

The addition of rear roof-mounted turn signals may provide additional warning of the intention of the bus merging back into traffic. In cities with these lights, drivers have fewer problems returning from the turnout into the curb lane. An example of a bus with rear roof-mounted turn signals is shown in Figure 82.

Recommendations:

It is recommended that far-side bus stop locations be used where possible. The use of rear roof-mounted turn signals may also improve the effectiveness of turnouts by improving the merge into traffic flow.

Delays

Drivers have identified several locations where buses are trapped in traffic backups due to long cycle times at traffic lights. It appears that many signalized intersections have very long cycle times for turning traffic. In general, stops should be moved to the far-side of the intersection at these locations; however, careful traffic engineering studies are needed to determine the safest movement for the bus. The Driver Fixed Route Committee should discuss these locations with management and the city and MoDOT engineers to determine if stops should be moved.

The driver/management team can develop objective criteria to measure the delays. After a standard delay time is determined, data can be collected to determine the delay at individual stops. Usually the long delays will be at near-side stops. Stops can be moved to far side or mid block to minimize delay and retain pedestrian access to nearby businesses.

Recommendations:

It is recommended that some stops should be relocated after analysis of delay time and traffic impacts. If relocation is not feasible, abandonment of the stop may be considered as an alternative, but only after a thorough review of the impacts to customers.

This review has identified two bus stops that cause particularly severe operational problems:

- The southbound stop on Route 5-S. Glenstone is a near-side stop at a railroad crossing with a turnout. After making a service stop, the bus is required to pull out into traffic and immediately stop to check the crossing. This is a difficult move and a wide traffic gap is needed for this slow speed maneuver. When stopped, the bus may not be completely in the traffic lane and the four-way flashers may not be visible to southbound motorists. Consultation with local traffic officials is needed to determine if this stop should be moved to the far-side of the railroad crossing. Moving the stop will give the driver adequate time to be completely in traffic, and visibility of the stopped bus will be maximized.
- The southbound Route 5-S. Glenstone stop at Glenstone/Cherry is a near-side stop. When passengers are transferring from Route 10-Cedarbrook, they often run through moving traffic to reach the Route 5-S. Glenstone bus. A far-side stop will provide a safer location for the bus to wait for the transfer. It will also show the passengers that the bus is stopped and waiting for them to cross safely.

Shelters and Benches

Springfield has a large number of shelters that appear to have average maintenance. There are 88 shelters in the system, approximately 10 percent of all stops and averaging approximately one shelter every two miles. While there are no national standards for shelter placement, the number of shelters in the CU transit system is high compared to other systems.

Benches are provided at many bus stop locations. Benches can be an important marketing element, especially in locations where bus customers cannot always control their arrival times. This usually occurs in commercial areas. Many of the benches and shelters are appropriately located in commercial areas as well as by high-density housing.

There are a few benches with seat boards that are cracked or damaged. The backboards were blank on many benches; this area can be used for self-promotion ads for CU. Bench maintenance should be increased.

Recommendations:

Maintenance of bus benches is currently done through the Facility Services department on an as-needed basis. It is recommended that a program be created to more proactively monitor and maintain benches in the system. It is also recommended that bus benches be utilized for CU marketing purposes as well as a potential source of advertising revenue.

System Observations and Recommendations

Schedule Reliability

The current CU schedule is well designed. The span of service is excellent and the departure times from Park Central Transfer Station work well to be able to deliver passengers to jobs that start on the hour and 30 minutes after the hour. With 30-minute intervals; however, it is difficult to schedule a convenient arrival for all work trips, as well as to schedule a convenient return trip from work that is time competitive with automobile trips.

The overall reliability of the CU schedule is good in the morning, but poor in the afternoon when traffic volumes increase. Additional resources are needed to improve afternoon schedule adherence. If buses were through routed from the north side to the south side using current schedules, there would be a 105-minute cycle time from the north end of the network to the south end and return to the north end. This is not adequate under current traffic conditions. An improved scheduling pattern would design a 120-minute cycle time from the north end of the system to the south end and return to the north end. This would provide adequate recovery time at the ends of the routes for future congestion caused by increasing auto traffic volumes. An Option to improve overall reliability is detailed in Part III of this report.

Evening Service

The evening CU bus network in Springfield is comparable to many cities that are attuned to the transit needs of their residents. Some communities operate fewer routes at reduced frequencies, while others operate combination routes. Often entire portions of a community are not served where there is low potential for transit ridership. CU operated a three route evening network for at least the last 40 years. A fourth evening route, Route 27-Red Route, was added in 2009.

The evening network that is currently in place combines most of the employment areas with residential areas. The geographic area covered is similar to the daytime network. Buses operate at one hour frequencies. The night network operates seven days per week and is also the entire Sunday and holiday daytime network.

This network meets many basic needs of current passengers by allowing them to return to their residence at the end of their work day. It also allows workers an opportunity to complete daily shopping chores. Although the customer survey did not separate shopping trips by time of day, many evening passengers were observed with shopping bags leaving commercial areas in the evening.

Comments from drivers indicated that some of the trips were overcrowded and drivers were transferring passengers between routes 25-Blue Route and 27-Red Route in the evening. This is a creative technique that allows the overloaded bus adequate room to pick up additional passengers while filling up the bus with available capacity. It is also an indicator that passenger traffic warrants an additional vehicle in the evening.

The primary customer complaint about the evening network is that it starts too early and all existing routes should operate one additional hour. This would require an additional 22 revenue hours per day compared to 4 hours to provide the evening network. There are other options to solve the overcrowding and circuitous routing of the evening network that do not require an additional 18 hours per day.

A secondary complaint voiced by several passengers was that it takes too long to complete a trip due to the loop nature of the routes. For example, a passenger from Battlefield Mall traveling to Park Central Transfer Station has a 15 minute ride during the day, but it is a 35 minute ride in the evening.

Drivers indicated that it is difficult to maintain the schedule on the first two evening trips, but field observations showed that most buses were arriving with a three to seven minute recovery time at Park Central Transfer Station. This is similar to observed daytime arrival and recovery times.

The remainder of the evening network is adequate.

Park Central Transfer Station

The downtown transfer station is in a difficult location for bus movements. It is restricted in size and traffic movement geometry; however, unlike many bus systems which use downtown transfer points as recovery points with long layover times, the current schedules minimize transfer waiting time at the facility.

The scheduling at Park Central Transfer Station is very efficient with adequate time to transfer between buses, but not excessive enough to add unnecessary delay to trips requiring a transfer. CU is currently studying various locations to relocate the transfer station. It is important to keep the tight transfer times to reduce overall passenger travel time regardless of where the new facility might be located.

Transfer Analysis

The ability to easily transfer from one route to another greatly expands transit customer access to multiple destinations beyond the reach of their nearest bus route. An analysis of transfer activity was conducted to identify key transfer locations and directions. Transfer passes were collected on all CU routes between September 25th and September 30th, 2011 and tabulated. A total of 4,197 transfers were collected. Of these, 337 were transfers between the same routes. Table 21 shows the results of the transfer analysis. The table is highlighted as a visual aid to more easily identify the magnitude of transfer activity between routes.

Table 21: Transfer Summary (Weekly Transfers for One Week of Data)

TO ROUTE \ FROM ROUTE	1	2	4	5	6	7	8	9	10	11	12	13	14	15	22	25	26	27	Total
1	21	34	13	21	44	32	28	9	6		11	23	39	5	1	1	1		**289**
2	50	77	15	55	68	99	31	49	26	4	69	14	44	19		4	4		**628**
4	10	2	1	8	13	28	1	27	1		20	3	5						**119**
5	41	67	22	65	71	84		45	45	48	41	20	112	2	9	10	8	4	**694**
6	72	22	18	59	26	60	1	24		8	47	18	79		17	39	4	11	**505**
7	55	61	32	68	81	36	1	36		15	38	16	87						**526**
8	14	33					21		2				13	9					**92**
9	11	37	17	31	30	30		10		4	17	16	34		6	31	7	3	**284**
10	9	41	6	6		1	9		8		1		1	1					**83**
11		1		37	1	40		8		5	27								**119**
12	22	51	15	36	41	43	5	29		65	23	18	60						**408**
13	8	7	1	14	15	10		1			7	2	8						**73**
14	7	8	5	13	23	16	11	4			17	1	12						**117**
15	1	42		1		1	2		2				1	1					**51**
22															5	15	11	11	**42**
25															17	8	25	17	**67**
26																			**0**
27															36	33	15	16	**100**
Total	**321**	**483**	**145**	**414**	**413**	**480**	**110**	**242**	**90**	**149**	**318**	**131**	**495**	**37**	**91**	**141**	**75**	**62**	**4,197**

The most common transfer direction with 112 weekly transfers is from route 14 to route 5. This is followed by transfers from route 7 to route 2 at 99 weekly transfers and transfers from route 14 to route 7 at 87 weekly transfers. In total, the largest number of transfers originate on the route 14. The most common destination route for customers is the route 5. The top ten transfer directions are summarized in Table 22.

Table 22: Top 10 Transfer Directions

Rank	From Route	To Route	Transfer Count
1	14	5	112
2	7	2	99
3	14	7	87
4	7	5	84
5	6	7	81
6	14	6	79
7	1	6	72
8	6	5	71
9	12	2	69
10	6	2	68

The CU Transit service area can be partitioned into a north and a south area with a dividing line approximately at Walnut St. Route 6-College does not fall completely within either of these categories and comprises a third west area. The number of transfers within and between the areas described area summarized in Table 23.

Table 23: Area to Area Transfers

Transfer Direction	Count	% of Total
North-South	1,525	36.3%
North-North	628	15.0%
South-South	841	20.0%
West-North/South	866	20.6%
Same Route	337	8.0%
Total	**4,197**	

It appears that the majority of transfer activity is between north and south side routes with 36.3 percent of all transfers. Transfers between west and north/south side routes comprise 20.6 percent of all transfers. North side to north side transfers were 15.0 percent of all transfers and south side to south side transfers were 20.0 percent of all transfers. Same route transfers made up 8.0 percent of all transfers.

Recommendations:

It is recommended that transfer activity be periodically monitored to better understand the travel patterns of transit customers. If routes are paired to allow run through scheduling where a north side route is paired with a south side route, then periodic transfer analysis will determine the best route pair combinations.

Vehicles

The purchase of new buses should be a very high priority. The current fleet has an average age of 11.8 years and 23 of the 25 buses will be past their design life in 2012. A grant has been recently received for $3,000,000 from FTA to replace the oldest buses.

The current 30-foot bus fleet has been adequate, but the 30-foot bus is not a good bus for future growth. Several trips were observed with standees. The one-door configuration of the current fleet is inefficient at locations, such as Park Central, where there are passengers exiting and boarding simultaneously.

The current uncertainty over the location of the new downtown transfer center should not preclude the purchase of new 35-foot buses. Three buses are needed for the #8, #10, #11, and #15 peak requirements. Three buses are also needed for the #5 schedule and the current Park Central facility can accommodate one 35-foot bus at each pulse. After the new facility is constructed, the 35-foot buses can be transferred to busier routes that use the new facility.

Recommendations:

New buses should be at least 35-feet long with two doors. Wheelchair ramps should be located at both doors to facilitate movements of some wheelchairs that are longer than average. Passengers in excess-length wheelchairs can enter the bus through the rear door and exit through the front. This pathway eliminates the need for passengers to turn their wheelchair 180 degrees when positioning themselves in the securement area. Passengers who have standard-size wheelchairs can continue to use the current entry/exit process.

New buses should be equipped with rear roof-mounted flashers. These are similar to the lights on garbage trucks and beverage delivery trucks. The amber lights are wired into the turn signals and four-way flashers. This will provide better warning to motorists who are several cars behind the bus when the bus is stopping or when the bus is attempting to move back into the curb lane from a cutout.

It is also recommended that five amber lights be installed on each exterior side of the bus and activated with the four-way flashers and turn signals to maximize visibility to motorists when buses are stopped in traffic or making a turn. Two would be on either side of each wheel and the fifth light should be in the center of the back of the bus.

The alternating red flashing lights that are activated upon brake application should also be continued. A center white strobe light, if allowed under Missouri law, should be installed at the roof line and activated with the four way flashers. An example on a minibus is shown below. Fixed-route and ACCESS buses should have the strobe light installed. The new paint scheme should have a blue reflective stripe on the rear of the bus.

The exterior light additions can easily be added as a change order if CU purchases the buses as part of a consortium or as a piggyback purchase of available optional buses from another transit system.

Figure 83: Strobe light in the center near the roof

Advertising Wrap Restrictions

The current full-wrap buses, while strong revenue generators, have disadvantages to passengers. People with sight limitations often have difficulty discerning the exterior locations and this makes it difficult for them to determine how close they are to their destination. The full-wrap buses also are difficult to see out at night.

The current wrap process covers the rear route sign, which makes it difficult for passengers transferring at Park Central to know their correct bus. For new customers, this is especially perplexing. The vehicle identification number is also not present on wrapped buses.

Many bus systems limit the window surface area that wraps can cover. This requires a more creative approach to wrapped buses, but improves the passenger experience while riding the vehicles.

Recommendations:

A 50% to 60% limitation on window surface area covered by wraps is recommended. A strong advertising message can still be accomplished with a partial wrap that is creative.

Figure 84: Example of partial wrap with maximum effectiveness

Figure 85: Example of partial wrap with maximum effectiveness

Marketing

Marketing of CU Transit service is done by the CU marketing department, which provides marketing for other CU business units as well as transit. The new paratransit buses and bus stop signs have an attractive paint scheme that will enhance the brand image. However, if CU is to expand into different demographic markets from its current ridership base, it will need to make improvements to its current print and electronic media.

Print Media

The print media used by CU is difficult to use for potential customers. Different formats have been tried in the last decade, and the current presentation of route map and individual schedules is not very effective in explaining the service to new customers. While the trip planner portion of the website is easy to use, it is difficult for a potential customer who uses print media to know their exact location in town and proximity to the nearest bus route.

The individual route maps show all departure times for each route. The system map shows first and last trip times and intermediate times as minutes after the hour. Individual trip times are not shown. Rush-hour-only service is shown by a red color text and is confusing. The inclusion of pull-outs and pull-ins to the garage is also confusing and consumes valuable space on the map. The subtle color shades used on the map to define routes, without corresponding route numbers, makes it extremely difficult for people with sight difficulties to determine which route to use.

Some timepoints on the individual schedules are 15 minutes apart. Good practice is to have timepoints approximately every 5 to 8 minutes with a maximum interval of 10 minutes. Closer timepoint spacing allows passengers to more accurately estimate the arrival time of their bus.

The individual route maps are somewhat better and show all departure times. However, they do not show connecting routes, or routes serving the same corridor. Several of the CU routes overlap and connect at locations other than downtown. Passengers may have a choice of routes, but the current

print information makes it difficult for passengers to discern their choices. The print size is also very small for the route map, which is difficult to read.

Recommendations:

- Provide closer timepoint spacing for route schedules
- Show connecting routes on individual route maps
- Increase print size on maps

Electronic Communication

CU has a reasonably sophisticated electronic media package. A Google Maps based origin-destination website allows passengers to enter their trip ends and the system will determine the best route and provide schedule arrival times. However, using the website to check several origin-destination pairs shows that there are some portions of the route network where Google does not recognize any bus stops. Potential new customers will assume that there is no bus service in the area if they use the current CU website.

Recommendation:

- The Google map database should be updated.

The website is easy to use and uses Google Translate to provide information. The website only indicates that it is available in French and Spanish, but the Google Translate technology makes the information available in 64 languages.

Recommendation:

- The Google translate capability should be enhanced on the home page to show that multiple languages are available.

CU has Facebook and Twitter for all business units. While in Springfield, a detour on Rt. #10 was experienced by the consultant, but had not been posted online. Electronic media can be effective, but it requires additional staff time to be meaningful and timely.

Recommendation:

The minimal level of electronic instant communication should be notifications of detours or significant service interruptions.

Social media can be very time consuming for staff and result in minimal benefit for the transit system. One example of a reasonable balance of useful information is the use of social media by MATBUS in Fargo, North Dakota. Their Twitter information is available at http://twitter.com/#!/MATBUS. Their Facebook page is at http://www.facebook.com/pages/matbus/99993153109. They provide a balanced mix of useful detour and immediate information along with creating a positive image of the transit system through their Facebook activities. If CU is going to move into serving a younger and more affluent passenger demographic, the transit marketing activities will need to include even more social media activities.

Future Markets

According to the on-board survey results, CU provides important access for low- and moderate-income people who are traveling to work, shopping, medical appointments, and social activities. With its

extensive span of service, good area coverage, reasonably competitive travel times in South Springfield, and good service delivery, CU has some untapped market potential.

There are three primary target markets that could generate significant ridership increases:

- Workers
- Population aged 65 and over
- College Students

The easiest target is more passengers within the primary demographic characteristics of current passengers. From the on-board survey, it has been determined that more than 37% of passengers are traveling to and from work. Work trip access can be expanded with improved frequency of service in order to coordinate with start and finish times at more business locations. Work trips are desirable to attract because they usually occur five or six days per week.

One example is Cox South Medical Center. A person finishing work at 3:30pm would need to wait until 3:50pm for a northbound bus on the Route #12. A 20-minute interval could provide a bus at 3:40pm (depending on scheduling), which would save prospective customers 10 minutes of travel time per day in the afternoon. Morning schedules could also be adjusted to provide more attractive bus/work time coordination.

The second demographic group that is likely to use transit more is people aged 65 and older. The on-board survey indicated that only 7 percent of current customers are within this age bracket. If the service meets their needs, often older households can rely on one automobile, but still have an active travel pattern. CU Transit can meet many of their travel needs when one person is using an automobile and the other needs to travel. With the good infrastructure for pedestrian access, one of the usual impediments for bus travel with retired people does not exist in Springfield.

The pricing for people over 65 is good; but again, the frequency of service may not meet their needs, especially if one person in the couple is engaged in part-time work or volunteer work. Improved frequency, combined with an aggressive marketing program aimed at the RIOC family (Retired Income, One Car), will result in increased transit usage.

Unlimited Access Program

The target market that has the greatest upside potential is college students. An Unlimited Access program designed for each higher education institution, combined with service improvements, can develop the student transit market. Funding for the program can be a partnership between CU and each institution. Fare replacement is easy to calculate to get the program started with the existing route network and service levels. If a school identifies additional service needs, CU and the school can develop a mutually acceptable service development plan where each entity contributes to the additional service.

As an example, if a school identified that it desired 15-minute frequency on a portion of an existing route, the school would be expected to pay for part of the improvement. Because the general population may also benefit from improved frequency, CU could also participate in funding the frequency improvement. This could occur in the first year or in a subsequent year.

Cost calculations for the improved services can be based on fully allocated costs minus state and federal revenues; or on marginal costs of operation with increased state funding used to provide additional

service in subsequent years. Cost models that benefit CU and the individual schools can be easily developed.

It may be most beneficial for the school to pay all marginal costs in the first year and as CU receives additional State Transit Assistance, the cost to the school could be offset by the increased state revenues.

If a school desires a specific new route designed to meet their student needs, CU would need to assess the wider benefit to the general public to determine a proper investment level of local public funds. A route that operates only on school days, but serves a wider service area, will not have the same public benefit as a route that operates on all weekdays. One option is for the school to fund the service on school days and CU to fund the service on weekdays when school is not in session. Other similar cooperative models of financial support can be developed.

Missouri State University

Missouri State University (MSU) is the largest of the schools in Springfield, but does not have city-wide bus services designed to meet student, faculty, and staff needs. The Bear shuttle meets intra-campus needs and connects facilities in downtown with central campus. A good city-wide service design is a function of residential locations, campus circulation, and community-wide travel needs and will meet the needs of students traveling to locations not served by the Bear shuttles.

Additional service frequency can be added to existing routes and could operate only on school days or, with additional funding, operate on all weekdays. An analysis of student residential locations would show what route improvements and new services would best meet the travel needs of MSU students.

Typically a university will have high concentrations of students surrounding the immediate campus as well as clusters of student residential housing in other parts of the community. Student-intensive housing areas are located along many of the existing CU routes and some of the south-side and downtown locations have a relatively direct routing to MSU.

Transit markets can be developed by analyzing the travel needs and the travel decision-making of the target market. For university students, travel time and perceived cost of the trip are two major factors in determining transit usage. A logical market development strategy for MSU students would be to work on the pricing component of the student market first and then work on the travel time component as a second step.

The first step in developing the MSU transit market would be to implement a Universal Access program, which allows all students to ride free on CU buses. Using available capacity on the existing network will minimize the cost of the program to MSU. Pricing can be determined by calculating the lost revenue from existing passengers. Daily ridership counts are available for students boarding and exiting at MSU on Route #12. This assumes that a system average fare per trip will allow a good estimate of the farebox revenue change if Unlimited Access is implemented. An adjustment can be made in the second year of the program if the initial estimate is incorrect.

After one year of operation with Unlimited Access there may be some changes in the distribution of student residences to take advantage of more direct service to MSU or those connecting routes that make a convenient connection to Route #12. At that time, a review of student housing patterns, compared to the current distribution, will show those locations where there will likely be long-term student housing. It may be necessary to adjust some routes if there are significant new travel patterns.

Ozarks Technical Community College

Ozarks Technical Community College (OTC) has a wide dispersion of students throughout Springfield and adjoining communities. The housing locations of OTC students are shown in Figure 86 and Figure 87.

Figure 86: OTC Student Home Locations, Regional

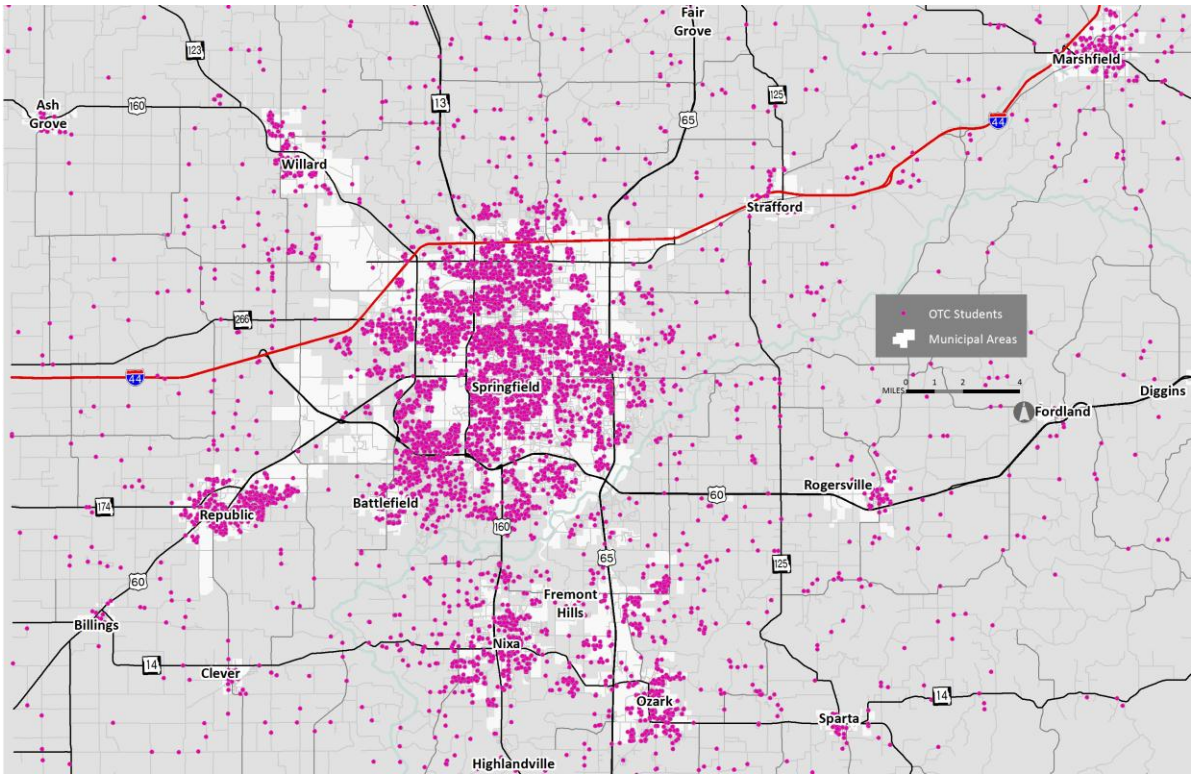
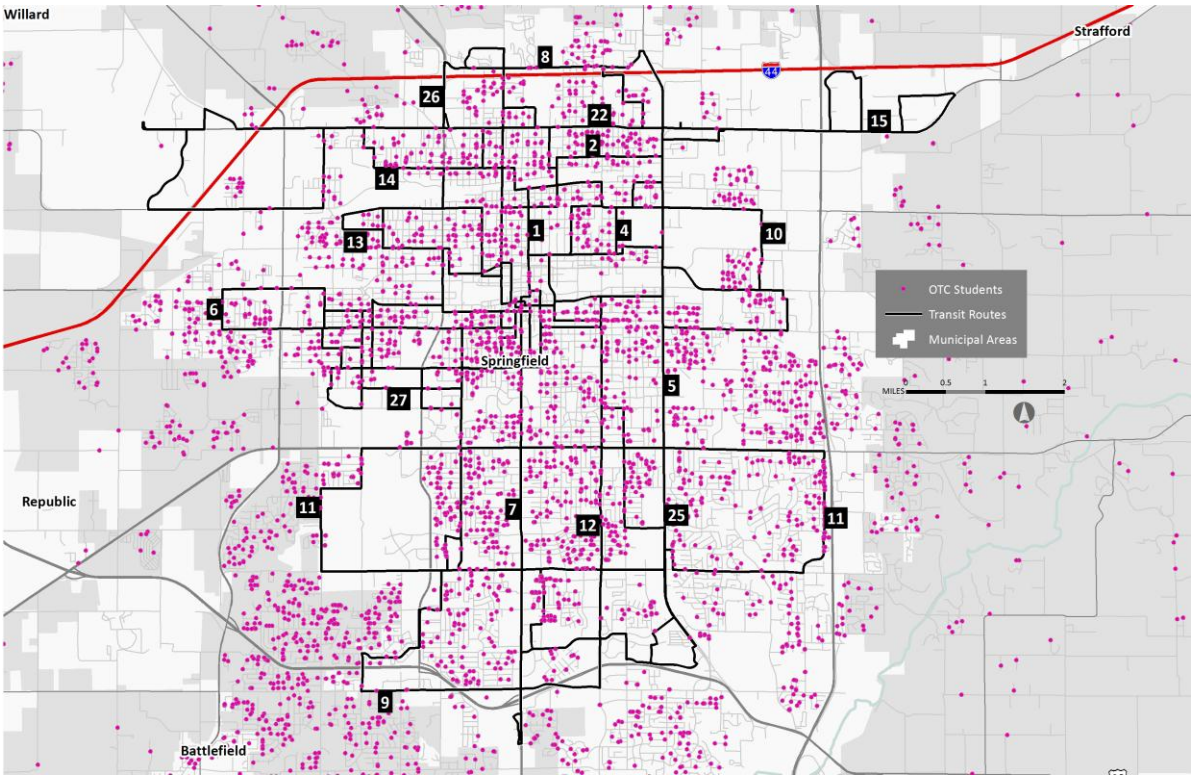


Figure 87: OTC Student Home Locations, Springfield



Examination of the figures shows that all of the routes in the CU network could provide access to OTC. Frequently, community college students have less financial resources and are especially price sensitive in making transportation decisions. Sometimes, the inability to afford transportation may affect their decision to continue in school. Unlimited Access for OTC would be beneficial to the student community, reduce parking demand on campus, and provide increased ridership on existing services. On/off counts on Rt. #14 and Rt. #4 can provide an estimate of lost farebox revenue.

One issue for student usage is the fare. The other issue is the service. The service on Rt. #4 with hourly headways is not attractive to current or potential OTC students. Expanding service to 30-minute intervals will make the service more attractive and increase ridership significantly if combined with Unlimited Access.

Other Schools

Community colleges and private, for-profit institutions tend to be smaller and have a student body composition that is commuter in nature and has a shorter career time at the institution. Often, there are a few apartment buildings that cater to individual schools, but there is usually a wider dispersion of housing locations compared to larger institutions.

This transit market can also be developed with proper pricing and route and schedule design that meets student transit needs at these institutions. In general, improvements to the existing fixed-route network will address many of the service needs of the student population. With a wider dispersion of housing, the existing fixed-route network will meet many of the route needs of this group of students. Unlimited Access, combined with service levels of 30-minute intervals or better, will be attractive to students at other schools in Springfield.

Other Businesses

Unlimited Access for businesses is a trend that has evolved from the UA programs for universities and colleges. CU would need to calculate the revenue received from employees of the business. The business would invest the lost revenue and be able to extend free rides to all employees. This program results in no loss of revenue for the transit system and a valuable perk for employees of the business at a modest cost.

Sustainability Issues

Many universities have sustainability committees and often have a strong ecological ethic within the student body and the administration. Unfortunately, many universities do not know how to create an ecologically strong transit system or how to measure the benefits.

One example of a good carbon calculator, designed for the public, is shown at: http://www.CUrtdirect.info/Web2/JourneyPlanning/JourneyEmissionsCompare.aspx.

It allows the user to determine how many miles they will travel by auto and by transit. By adjusting the mode shares, the user can see their individual difference if they use transit more frequently. Many students are flexible in their travel modes and will use their car or transit depending on which is more cost and time effective. A well-designed transit system can have a significant impact on total emissions within the university community.

An example of university commitment to the environment is shown in the Talloires Declaration (TD). It is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research,

operations and outreach at colleges and universities. It has been signed by over 400 university leaders in over 50 countries. Additional information is available at http://www.ulsf.org/talloires_declaration.html

CU encourages conservation of resources and should expand the conservation concept to the transit system. A commitment to environmental sustainability can be demonstrated through a commitment to improved transit service.

Suburban Service

The initiation of transit service to the nearby communities surrounding Springfield could begin with a renewed effort toward a carpool/vanpool program. Ideally commuter matching would group people in one town with an employer in Springfield. Best practices for carpool/vanpool include incentives for the driver; reasonable pricing for the passengers; a conflict resolution process; reasonable and timely equipment replacement; standards for the drivers; a reserve driver; and midday transportation for emergencies.

A well-designed carpool/vanpool program includes administrative oversight and involvement as well as continuous marketing of the product. The logical place for this is in the MPO and resources should be dedicated to expand the current program and make it successful.

Vanpool and carpool programs can be used as effective planning tools for fixed routes. They will show where people are willing to use a mode other than their personal auto and will show primary destinations in Springfield as well as desired times for arrival at the start of the work day and departure times at the end of the work day.

After usage patterns are established, the next investment level will be the creation of fixed-route service. Good to very good levels of service are required to be successful. Pricing must also be competitive with the perceived costs of operating an automobile. Most suburban riders will continue to own a car, so pricing must compete with the marginal cost of operating an automobile and not consider the capital costs of ownership. The new fixed route will divert some of the vanpool and carpool passengers from their cars and vans and it will also attract potential customers who desire the advantages of fixed-route service.

The vanpool/carpool system will establish parking locations where people can gather to meet their car or van. These sites will also be logical sites for park and ride for the fixed-route buses in the suburban areas.

The OTO Rideshare Matching Services program consists of the following information from the OTO website:

- The Ozarks Transportation Organization has implemented a web-based rideshare-matching program (www.ozarkscommute.com) where commuters can find a ride to share.
- Vanpool/Employer Shuttle Programs: Several area employers and multifamily housing complexes have implemented vanpool or shuttle programs. Examples include: St. Johns Medical Center, TLC Properties, Missouri State University, and Prime Trucking.
- Improved/Increased Park-and-Ride Facilities & Capital Improvements: There are existing park-and-ride lots within the OTO area which are currently underutilized. Accordingly, expansion is not planned at this time.

Ozarks Transportation Organization
Fixed Route Operations Analysis

Part III: Phasing of Improvements

Incremental Service Improvement Scenarios

Presented in this part of the report are five levels of transit investments that would improve bus service in Springfield. Each level is designed to be incrementally added in order for the Transit Department to have adequate time to plan and implement the recommendations.

Level I addresses immediate needs of the existing service. This includes additional resources to improve service reliability and to fill immediate service deficiencies. The focus of the first level is to enhance the reliability of the existing network. It also includes some route changes that combine segments of various routes to provide better connectivity within the overall CU system. Minor improvements to evening service are also included as well as investments in transit operations technology.

Level II Investments consist of a series of improvements that focus on improving frequency on existing busy routes. The improvements may be incrementally implemented as equipment and drivers become available.

Level III Investments address the needs for east-west travel on the far south side. These improvements will fill in some of the gaps in the current route structure in this area. Two additional neighborhood circulator routes are also proposed.

Level IV Investments provide improved frequencies on the enhanced system for both weekday and weekend service. These improvements also include the implementation of limited stop service on some of the busiest routes.

Level V provides an extensive and comprehensive transit system with frequent service on existing and new routes. Crosstown service is added to fill out the service grid at ½-mile spacing. This level of investment will allow Springfield residents to have viable choices of travel modes to meet many of their transportation needs.

To calculate the cost of each recommendation, the change in service hours was calculated and compared to a baseline existing condition as shown in Table 24. The change in service hours was calculated based on changes to the frequency and span of service. Final cost was calculated assuming an operating cost of $90 per service hour which includes all operating expenses including fuel, maintenance, and driver and supervisor personnel. The costs of capital and non-service-related improvements are also tabulated for each level of investment.

Ridership estimates for improvement to existing service were calculated using the commonly-used assumption that Springfield transit ridership will have an elasticity of 0.5 with respect to frequency improvements[6]. That is, for every 1 percent increase in service hours due to frequency improvements, there will be a 0.5 percent increase in ridership. For ridership estimation on new routes, a passengers per service hour value was assumed based on existing values of adjacent routes.

Implementation of major service changes should be staggered over a number of years to let customers adapt to the new service patterns. It is recommended that a period of two to three years be used as the implementation timeframe for each level of change.

[6] http://www.vtpi.org/tranelas.pdf [p. 10, Service Elasticities]

Table 24: Existing Service

Existing	Weekday						Evening					Saturday					Sunday				
Route	Span of Service	Frequency (AM/Mid/PM)	Trips	Cycle Time (min)	Service Hours	Peak Buses Required	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours
1	13	30	26	45	19.5	1.5	-	-	-	-	-	12	60	12	45	9	-	-	-	-	-
2	12	30	24	45	18	1.5	-	-	-	-	-	12	60	12	45	9	-	-	-	-	-
4	12	60	12	30	6	0.5	-	-	-	-	-	12	60	12	30	6	-	-	-	-	-
5	12	30/30/20	27	60	27	3	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
6	12	30	24	60	24	2	-	-	-	-	-	12	60	12	30	6	-	-	-	-	-
7	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
8	13	60	13	60	13	1	-	-	-	-	-	12	60	12	30	6	-	-	-	-	-
9	12	60/60/30	15	60	15	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
10	12	60	12	30	6	0.5	-	-	-	-	-	13	60	13	30	6.5	-	-	-	-	-
11	12	60	12	60	12	1	-	-	-	-	-	6	60	6	60	6	-	-	-	-	-
12	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
13	12	60	12	30	6	0.5	-	-	-	-	-	11	60	11	30	5.5	-	-	-	-	-
14	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
15	12	60	12	30	6	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
25	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
26	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
27	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
TOTAL					**224.5**	**20**					**20**					**114**					**64**
					Spare:	**5**															
					Total:	**25**															

AM Peak:	**3 hours**
PM Peak:	**3 hours**
Weekdays / Year:	**255 days**
Saturdays / Year:	**52 days**
Sundays / Year:	**52 days**
Service Cost / Hour:	**90 dollars**

Annual Service Hours:	**72,644**
Annual Service Cost:	**$6,537,915**

** The service hours shown in this figure are model estimates only intended to represent a baseline for evaluation of future options.*

Level I: Current System Improvements

Level I improvements focus on improving the reliability of the existing system. They consist of several changes that will require three to four months to implement and include no-cost route combinations, increased cycle times on select routes, and supervisory additions. The Level I service improvements can be summarized as follows:

- No-Cost Route Combinations
- Improved Reliability of Existing Service
- Additional Garage Supervisor
- Mobile Supervisor
- Technological improvements (AVL, APC, TSP)
- 2 additional heavy-duty buses

Service Improvements

No-Cost Route Combinations

The Level I system improvements will assume the implementation of the No-Cost Route Combinations as described in Evaluation of Existing System Chapter. These combinations include Routes 4 and 10, Route 8 and 13, and Routes 8 and 15.

Reliability

Within Springfield, automotive traffic volumes have increased more than 10 percent from 2002 to 2010. This has resulted in increased congestion and delays in some parts of the community, but scheduled cycle times for bus routes have not changed. Despite traffic flow improvements and a number of significant route changes over the past eight years, schedule reliability is becoming more problematic for CU Transit. Drivers indicated that most of the south-side routes have schedule adherence problems and this observation correlates with increased traffic volumes and passenger volumes.

The magnitude of the increase in congestion is highlighted in the OTO Congestion Management Process Phase III report (June 17, 2010). In reviewing this document it is apparent that roadway congestion has increased significantly in recent years. In 2005, there were 17 intersections on bus routes that had a p.m. peak Level of Service of D, E, or F. By 2008, the number of intersections with poor Levels of Service had increased to 35. During that same period, the number of congested facilities increased from eight to twelve. According to that report, morning peak congestion is less than the afternoon peak congestion. Increasing levels of congestion negatively impact the reliability and on-time performance of bus transit service by slowing the average bus speed.

The initial investment in improved reliability will require one additional vehicle in the afternoon that would be assigned between Route 7 and Route 12. This would provide 15 minutes of additional cycle time each hour so that each route would have a 75-minute cycle instead of a 60-minute cycle. The morning service operates reasonably close to its schedule and as a result, it is recommended that the morning schedules remain unchanged. Extra hours should be added for the midday and p.m. peak periods.

An additional peak vehicle should also be invested on Route 5 to extend the cycle time from 60 to 80 minutes. As with Routes 7 and 12, the morning scheduled trips are reasonably close to schedule. Therefore, the cycle time should only be extended during the midday and p.m. peak periods.

To improve operational efficiency, Routes 1 and 7 and Routes 2 and 12 should be combined and operated as a single route. Route cycle times would be:

- Route 1/7: 105 minutes (a.m. Peak); 120 minutes (Midday/p.m. Peak)
- Route 2/12: 105 minutes (a.m. Peak); 120 minutes (Midday/p.m. Peak)
- Route 5: 60 minutes (a.m. Peak); 80 minutes (Midday/p.m. Peak)

Two additional peak buses are needed to implement this strategy, raising the peak bus requirement from 20 to 22. The fixed route fleet size will be 27 heavy-duty buses for Level I improvements.

A layover location on the south side would be needed for Routes 7 and 12 for schedule recovery of approximately five to seven minutes. Library Center and Cox South are possible locations, but traffic studies are needed to determine the impact of buses waiting for their departure time at these locations. With scheduled recovery time, buses will be able to leave the southern terminal more on time. The reliability of northbound trips at intermediate timepoints will also be greatly improved. Additional timepoints should be added to the public timetables to make it easier for passengers to estimate the arrival time on these routes.

Sunday and Evening Service

The evening ridership on the south side is currently very strong. This indicates a very healthy evening network that meets a variety of travel needs.

The current strength of the evening and Sunday network can be enhanced with additional investment to reduce overcrowding. Route 25 should be split into its two underlying daytime routes. Routes 5 and 12 should operate on their daytime configuration on evenings and Sundays.

A reasonable ridership increase can be expected because bi-directional routing will reduce total passenger travel time in the network and make the evening service more attractive to current passengers who may be using other means of transportation in the evening. Productivity (passengers per service hour) will decrease initially, but it should return to or exceed the current productivity level within one to two years. The other three evening routes should continue in their current configuration and cycle times.

Non-Service Improvements

Span of Supervision

Currently, there is not an adequate span of supervision for CU transit services. FTA Safety and Security reviews have indicated that a supervisor should be on duty at the garage or on the street at all times buses are in operation. The logic behind this practice is that a supervisor on duty can respond quickly to an unusual event, such as an accident, passenger incident, criminal activity, or service interruption. Calling a supervisor at home is not as effective or efficient as having a supervisor respond immediately. Communication errors with public safety personnel are minimized when the supervisor is present at the garage or on the street.

Security concerns also suggest that a supervisor be on duty in the event of a major catastrophe, such as an earthquake, tornado, nursing home evacuation, or some other fast-moving catastrophic event where minutes are important in providing a safe and appropriate supervisory response.

Additional supervision is necessary to have someone on duty at the garage whenever buses are operating. On weekdays supervision should be provided until 11:30 p.m.; Saturdays from 5:30 a.m. to 11:30 p.m.; and Sundays from 7:00 a.m. to 11:30 p.m. This level of supervision requires an additional 57 hours per week. Actual hours may vary slightly depending on final scheduling. A 40 hours shift can easily be developed and it might be beneficial to have a combination supervisor/safety position to round out another 40 hours shift. As the system grows and adds more employees, it will require additional resources for the safety and training program.

Mobile Supervisor

Customer service provided by the drivers is generally very good with many positive interactions observed. However, several customers complained that they have to leave home two hours before their work start time due to missed transfers at Park Central.

Conversations with drivers indicated that some drivers do not wait for late buses and passengers are stranded at Park Central for 30 minutes. The current system puts the burden of solving late bus problems completely on the drivers. A cascading effect often occurs when one bus waits for a late bus and then has a transfer to a third bus. A mobile supervisor is needed to solve late bus problems and missed transfers. This will require an additional supervisor on weekdays using an available spare vehicle.

A systems approach to this problem analyzes the causes of late buses and provides external support to the drivers for problems that are beyond their control. A slow train, fire event, traffic accident, or malfunctioning traffic lights are typical causes of one-time events that make buses late. When the cascading effect occurs, one event can cause buses to be late over several hours.

Another concern is that late buses often occur on a recurring basis. High passenger volumes, high auto traffic volumes, and long traffic light cycles often cause delays to occur at predictable times in predictable locations. For these situations, a consistent response is required.

There are two strategies to resolve late buses. For infrequent, non-repetitive late buses, a mobile supervisor in a minibus, similar to ACCESS buses, is the best solution. The purpose of the mobile dispatcher is to restore service promptly. CU has used this position occasionally and it is known as the “wildcat.” This position should be formalized and the role should be on duty at least 40 hours per week. The recommended shift is from 630 a.m. to 830 a.m. and from noon to 600 p.m.

The primary function of the “wildcat” position would be to determine the best response to minimize service disruptions. Many options are available to mobile supervisors. They can wait for late transfers and deliver the passengers within a defined radius of the central transfer point. Alternatively, they may cover a low ridership portion of a route and allow the regular bus to bypass portions of the route.

The mobile supervisor would also document consistent late buses and work on determining the causes. If traffic and passenger volumes are the primary causes of consistently late buses, then the mobile supervisor would order an extra bus and driver to be inserted into the schedule at the predictable times. This would allow the mobile supervisor to remain free to resolve unusual and unexpected service problems.

Drivers indicated that buses are frequently caught in heavy traffic during the winter holiday shopping season. Extra buses would be scheduled for peak times and would be dispatched by the mobile supervisor as needed to cover missed trips from the downtown transfer center or from outlying terminals.

Automatic Vehicle Locator

CU does not currently provide real-time information to customers. Real-time information has become a standard expectation of high-quality transit service in many cities. The price for Automatic Vehicle Location (AVL) has declined significantly and the reliability of the technology has increased in the last few years. AVL would benefit customers by providing accurate information to their smart phone and through web based information outlets.

AVL is also a valuable tool for management to know where buses are located at all times. AVL would also benefit paratransit scheduling as well as a fixed-route mobile dispatcher. The mobile dispatcher can make informed decisions on how to accommodate late buses with real time information.

The cost of implementing and maintaining AVL systems depends greatly on the needs of the transit agency and the level of sophistication desired. A basic AVL system can cost approximately $8,000 to $10,000 per vehicle in capital costs with an ongoing annual operations and maintenance cost of up to $1,000 per vehicle.

Automatic Passenger Counters

As part of the AVL system, Automatic Passenger Counters (APC) should also be considered for installation on new buses. This will make it much easier to collect and analyze data for future schedule and route changes. The Driver Fixed Route Committee and the Passenger Fixed Route Committee will be able to analyze suggestions much easier with improved data. Future planning studies will have additional data which will provide valuable information in analyzing route performance.

As with AVL systems, the cost of implementing an APC system can vary depending on the needs of the transit agency. APC systems can cost approximately $4,000 to $5,000 per bus for capital costs with an additional ongoing annual operations and maintenance cost of $1,000 per vehicle.

Transit Signal Priority

The two primary sources of delay on bus transit routes are the time needed for boardings/alightings and time lost due to traffic signal delay. The latter may be improved through the use of a transit signal priority (TSP) system. TSP functions by either increasing the green phase or decreasing the red phase of a traffic signal when a bus is present, enabling it to spend less time stopped at traffic signals. The use of TSP can increase transit travel speed by 15 percent or more.

The implementation of the system requires a transponder device installed on each bus and additional hardware installed at the target intersection traffic signals. As such, the installation of TSP systems requires coordination and agreement with the city or county which has jurisdiction over those signals.

The cost of TSP ranges from $10,000 to $20,000 per intersection plus approximately $1,000 per vehicle. However, once installed the operations and maintenance costs of the system are minimal. A detailed study is required to fully assess the costs and benefits of implementing TSP in Springfield.

Vehicle Requirements

CU should begin purchasing 35-foot heavy-duty, two door buses, with wheelchair ramps in both doors. All references to bus purchases assume that new heavy-duty buses will be 35 foot buses unless otherwise noted. There are locations where 30 foot buses would be adequate and there is an option for medium duty body on chassis buses on new neighborhood circulator routes. However, if CU determines that a standardized fleet is desired, all purchases can be 35-foot heavy-duty buses.

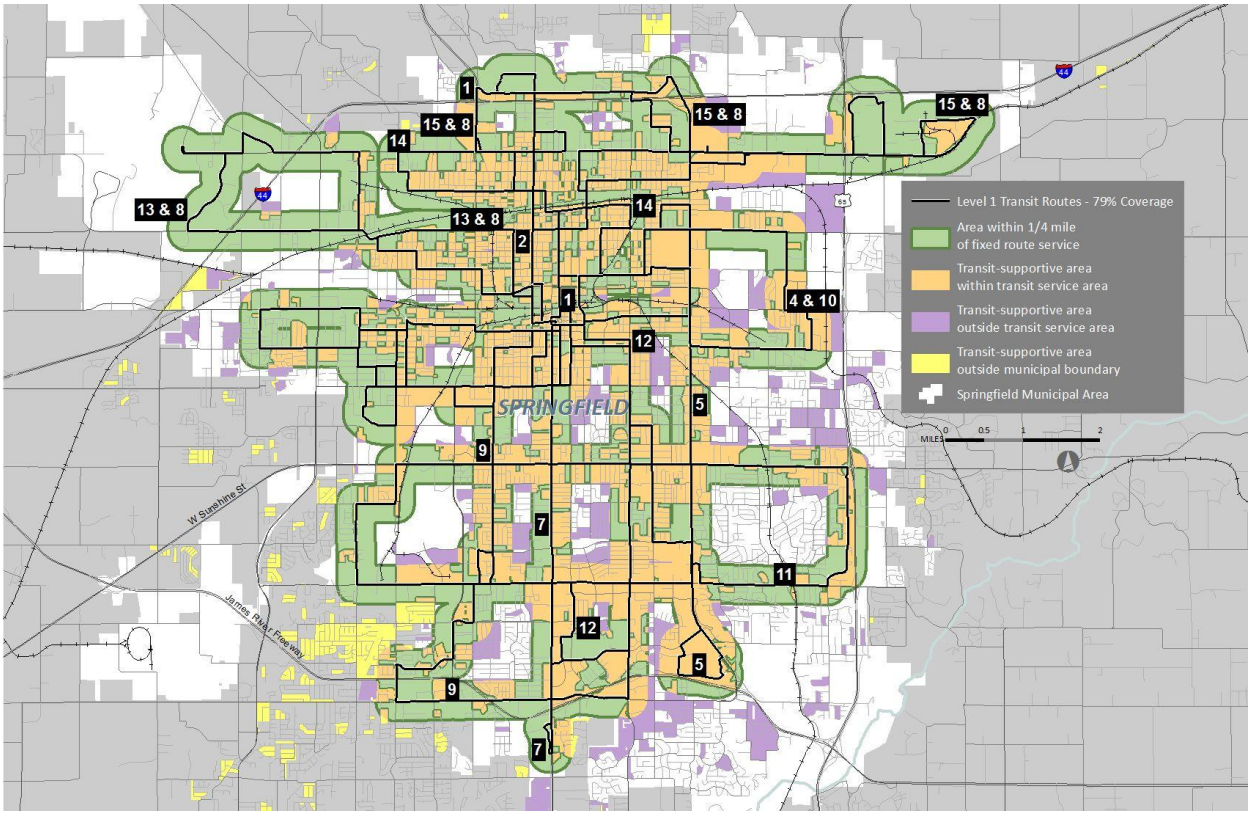
Table 25: Level I Vehicle Requirements

	Peak	Spare	Total
Existing Base Level	20	5	25
Level I	22	5	27

System Map and TSA Coverage

The effects of Level I improvements on the overall weekday system map are shown in Figure 88. The route combinations would have no impact on the existing Transit Supportive Area (TSA) service coverage of 79 percent.

Figure 88: Level I Weekday System Map and TSA Coverage



Summary of Level I Improvements

Level I improvements consist of:

- Realignment of route segments on the north
- Additional garage supervision
- Creation of a mobile supervisor program
- Additional resources to improve reliability of service on the south side.
- 2 additional heavy duty buses

The ridership impacts of Level I improvements are shown in Table 26. Ridership is not projected to change as a result of the no-cost route combinations. The projected ridership numbers shown represent the sum of the existing ridership on the underlying routes. In the case of Route 8, half of the current ridership was allocated to the Route 8/13 combination and half was allocated to the Route 8/15 combination. Routes with modified cycle times are also not projected to see any change in ridership. Although this modification will result in an increase in annual service hours, the service provided to customers will effectively remain constant.

Ridership will increase as a result of replacing Route 25 with Routes 5 and 12. This change will double the service hours currently provided by Route 25 alone and will result in a 50 percent increase in ridership split evenly between Routes 5 and 12.

Table 26: Level I Ridership Impacts

Existing Route	Existing passengers	Level I Route	Level I Additional Passengers	Level I Total Passengers
1	95,208	**1/7**	-	269,986
2	145,948	**2/12**	-	280,332
4	40,917	**4/10**	-	69,089
5	183,787	**5**	37,037	220,824
6	130,791	**6**	-	130,791
7	174,778	**-**	-	-
8	43,829	**-**	-	-
9	77,477	**9**	-	77,477
10	28,172	**-**	-	-
11	44,284	**11**	-	44,284
12	134,384	**-**	37,037	37,037
13	36,827	**8/13**	-	58,742
14	160,063	**14**	-	160,063
15	12,354	**8/15**	-	34,269
22	46,908	**22**	-	46,908
25	49,382	**25**	-49,392	-
26	40,370	**26**	-	40,370
27	35,290	**27**	-	35,290
Total	**1,480,769**	**Total**	**24,691**	**1,505,460**

The capital and operational costs associated with Level I improvements are summarized in Table 27 and Table 28. The capital and operational costs associated with deployment of AVL and APC systems for the overall system are not included in this summary. However, the $400,000 large bus vehicle cost is assumed to include AVL and APC capability. Service-related cost impacts are summarized in Table 29.

Table 27: Level I Capital Cost Summary

Improvement	One-Time Cost
2 Large Buses @ $400,000 per bus (Cost includes AVL and APC)	$800,000
TOTAL	**$800,000**

Table 28: Level I Operational Cost Summary

Improvement	Annual Cost
Baseline Existing Operational Cost (Fixed Route Service Only)	$6,537,915
Level I Additional Operational Costs	$660,555
Additional Supervisory Positions (2 x 2080 hours @$50/hour)	$208,000
TOTAL	**$7,406,470**

Table 29: Level I Service Costs

Level I	Weekday						Mon-Sat Evening					Saturday					Sunday				
Route	Span of Service	Frequency (AM/Mid/PM)	Trips	Cycle Time (AM/Mid/PM)	Service Hours	Peak Buses Required	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours
1/7	13	30	26	105/120/120	50.5	4	-	-	-	-	-	12	60	12	105	21	-	-	-	-	-
2/12	12	30	24	105/120/120	46.5	4	-	-	-	-	-	12	60	12	105	21	-	-	-	-	-
4/10	12	60	12	60	12	1	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
5	12	30/30/20	27	60/80/80	34.0	4	5	60	5	60	5	12	60	12	60	12	16	60	16	60	16
6	12	30	24	60	24	2	-	-	-	-	-	12	60	12	30	6	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	12	60/60/30	15	60	15	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	12	60	12	60	12	1	-	-	-	-	-	6	60	6	60	6	-	-	-	-	-
12	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
8/13	13	60	13	60	13	1	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
14	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
8/15	13	60	13	60	13	1	-	-	-	-	-	12	60	12	60	-	-	-	-	-	-
22	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
27	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
TOTAL					**244**	**22**					**25**					**114**					**80**
					Spare:	**5**															
					Total:	**27**															

AM Peak:	**3 hours**
PM Peak:	**3 hours**
Weekdays / Year:	**255 days**
Saturdays / Year:	**52 days**
Sundays / Year:	**52 days**
Service Cost / Hour:	**90 dollars**

Existing Service Hours:	**72,644**
Level I Service Hours:	**79,983**
Existing to Level I Hours Increase:	**7,340**
Existing to Level I Cost Increase:	**$660,555**
Total Level I Annual Cost:	**$7,198,470**

Level II: Improved Frequency

Level II investment would provide an increase in overall mobility for CU passengers. By making the improvements in Level I, management would have adequate staff to address the growth challenges that would occur in Level II. More frequent service would have the greatest positive effect on transit mode split in Springfield and potentially result in a significant increase in ridership over a two year growth period.

The investments under Level II include:

- 20 minute peak frequency and 30 minute midday frequency on Routes 1/7, 2/12, 5, 6, and 14
- 30 minute all day frequency all Routes 9 and 4/10
- 30 minute Saturday service from 10:00 a.m. to 6:00 p.m. on Routes 1/7, 2/12, 5, 6, and 14
- 8 additional heavy-duty vehicles

Service Improvements

20 Minute Peak Period Frequency

Introduction of 20 minute peak frequencies on the busiest routes would be the primary driver of ridership increases. The Level of Service (LOS) for frequency on these routes would move from D to C. At LOS C, people who have a choice of modes will seriously consider transit for their trips. An aggressive marketing program aimed at "choice riders" would also be needed to influence their mode choice.

The immediate beneficiary of more frequent service would be the current passenger base. Passengers with day or monthly passes would make more trips per day because their waiting times will be reduced. Often, passengers will make trip chains similar to automobile drivers. For example, after work, they may travel to one or two shopping destinations before returning home. The savings of up to 20 minutes per trip allows more time to make more trips and provides increased mobility for transit customers.

More frequent service also better coordinates with work start and end times which reduces waiting time and makes transit service more attractive. Some passengers may currently be making one trip per day to work and riding home with a co-worker. More frequent service is attractive to this passenger group as it allows them to travel independently or do trip chaining after work.

The initial 20 minute peak frequency should be implemented first on the strongest routes in the system. On the north side, this would be Routes 1, 2, and 14. On the south side, this would be Routes 5, 7, and 12. The existing Route 5 has 20 minute service in the p.m. peak period. This is accounted for in the calculation of additional cost. Route 6 on the west side is an important feeder route into the system and a 20 minute interval on this route will enhance travel opportunities for west side residents. Buses can be through routed from north side to south side to guarantee connections (1/7; 2/12) for the through routed pairs while Routes 5, 6, and 14 can remain independent.

30 Minute Weekday Frequency

The current frequency on Route 9 is 60-minutes through most of the day with 30-minute intervals during the p.m. peak period. This area is growing with additional residential and commercial development and would eventually be equal in job and residential density to the areas of Springfield immediately to the east of this corridor.

Operating buses at 30-minute intervals all day will provide more opportunities for a convenient time connection between work start and finish times for people in this corridor. It will also provide better connections for students traveling to MSU, OTC, and the other higher education institutions in the service area. If ridership numbers increase dramatically, then 20 minute intervals in peak times can be implemented for Route 9.

The combination of Route 4 with Route 10 under Level I will provide better service for the Cedarbrook area; however it would not provide better service to OTC. The current one hour headway is not conducive to high student ridership. A twelve-hour per day investment under Level II would provide 30-minute service all day to OTC. This will provide better coordination with class times and make the service more attractive to OTC students. If Unlimited Access is negotiated with OTC, it may be necessary to run extra trips at peak times, or to consider 20 minute intervals. Without Unlimited Access, the 30 minute interval will most likely be adequate for the near term.

Saturday Service

The strongest routes (Routes 1, 2, 5, 6, 7, 12, and 14) should receive additional Saturday daytime service to complement the enhanced weekday service. These routes should operate at 30 minute intervals on Saturday from 10:00 a.m. to 6:00 p.m. This would enhance better coordination of work start and finish times for people who work on Saturday. It would also provide greater mobility for people who are shopping or have other trip purposes.

Vehicle Requirements

Level II requires a significant increase in vehicles. An additional seven heavy-duty fixed route buses are needed to meet the peak requirement above the Level I bus requirements. One additional spare bus should also be added to the fleet for a total of 6 spares. Fleet size will increase to **35 heavy-duty fixed route vehicles.**

Table 30: Level II Vehicle Requirements

	Peak	Spare	Total
Level I	22	5	27
Level II	29	6	35

System Map and TSA Coverage

Level II improvements will have no impact on the overall route structure and CU Transit system maps. As a result, the TSA coverage will remain at 79 percent as in the existing and Level I service.

Summary of Level II Improvements

Improved frequency on the primary routes would create a more robust transit service in Springfield. With an aggressive marketing program, new transit markets can be developed.

Level II improvements will result in ridership increase as summarized in Table 31. In total, ridership is projected to increase by 174,161 from Level I ridership levels to a total of 1,679,621 annual rides.

Table 31: Level II Ridership Impacts

Route	Level I Passengers	Level I Service Hours	Level II Service Hours	Service Hours % Increase	Passengers % Increase	Level II Additional Passengers	Level II Total Passengers
1/7	269,986	13,970	17,384	24.4%	12.2%	32,998	302,984
2/12	280,332	12,950	16,364	26.4%	13.2%	36,961	317,293
4/10	69,089	3,684	6,744	83.1%	41.5%	28,693	97,782
5	220,824	11,661	12,738	9.2%	4.6%	10,198	231,021
6	130,791	6,432	8,118	26.2%	13.1%	17,142	147,933
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
9	77,477	4,449	6,744	51.6%	25.8%	19,983	97,460
10	-	-	-	-	-	-	-
11	44,284	3,372	3,372	0.0%	0.0%	0	44,284
12	37,037	2,367	2,367	0.0%	0.0%	0	37,037
8/13	58,742	3,939	3,939	0.0%	0.0%	0	58,742
14	160,063	6,744	8,586	27.3%	13.7%	21,859	181,922
8/15	34,269	3,315	3,939	18.8%	9.4%	3,225	37,494
22	46,908	2,367	2,367	0.0%	0.0%	0	46,908
25	-	-	-	-	-	-	-
26	40,370	2,367	2,367	0.0%	0.0%	0	40,370
27	35,290	2,367	2,367	0.0%	0.0%	0	35,290
Total	**1,505,460**	**79,983**	**97,397**			**171,060**	**1,676,520**

The capital and operational costs associated with Level II improvements are summarized in Table 32, Table 33, and Table 34.

Table 32: Level II Capital Cost Summary

Improvement	One-Time Cost
8 Large Buses @ $400,000 per bus	$3,200,000
TOTAL	**$3,200,000**

Table 33: Level II Operational Cost Summary

Improvement	Annual Cost
Level I Total Operational Costs	$7,406,470
Level II Additional Operational Costs	$1,567,215
TOTAL	**$8,765,685**

Table 34: Level II Service Costs

Level II	Weekday						Mon-Sat Evening					Saturday					Sunday				
Route	Span of Service	Frequency (AM/Mid/PM)	Trips	Cycle Time (AM/Mid/PM)	Service Hours	Peak Buses Required	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq (Peak/ Off-Peak)	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours
1/7	13	20/30/20	32	105/120/120	61.75	6	-	-	-	-	-	12	30/60	18	105	31.5	-	-	-	-	-
2/12	12	20/30/20	30	105/120/120	57.75	6	-	-	-	-	-	12	30/60	18	105	31.5	-	-	-	-	-
4/10	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
5	12	20/30/20	30	60/80/80	37.0	4	5	60	5	60	5	12	30/60	18	60	18	16	60	16	60	16
6	12	20/30/20	30	60	30	3	-	-	-	-	-	12	30/60	18	30	9	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
9	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
11	12	60	12	60	12	1	-	-	-	-	-	6	60	6	60	6	-	-	-	-	-
12	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
8/13	13	60	13	60	13	1	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
14	12	20/30/20	30	60	30	3	-	-	-	-	-	12	30/60	18	60	18	-	-	-	-	-
8/15	13	60	13	60	13	1	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
22	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
27	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
TOTAL					**303**	**29**					**25**					**162**					**80**
					Spare:	**6**															
					Total:	**35**															

AM Peak:	**3 hours**
PM Peak:	**3 hours**
Weekdays / Year:	**255 days**
Saturdays / Year:	**52 days**
Sundays / Year:	**52 days**
Service Cost / Hour:	**90 dollars**

Level I Service Hours:	**79,983**
Level II Service Hours:	**97,397**
Level I to Level II Hours Increase:	**17,414**
Level I to Level II Cost Increase:	**$1,567,215**
Total Level II Annual Cost:	**$8,765,685**

Level III: South Side Improvements

The third level of investment would focus primarily on the south side. The improvements in service in the first two levels are proportionally divided between north, south, and west side and are designed to enhance overall mobility as well as provide better connections between work and residences. The third level addresses east-west trips that remain exclusively on the south side.

The current network does not serve east-west travel on the far south side very well. The Level III improvements would meet the needs for exclusive south side travel and provide better service for a variety of trip purposes. Two new routes are added on the south side as part of Level III.

The recommendations for Level III improvements are:

- Operate new Route 11 on Sunshine from Walmart to Ingram Mill weekday daytime at 30 minute intervals
- Operate new Route 16 on Battlefield from Walmart on Sunshine to Ingram. Mill weekday daytime at 30 minute intervals
- Provide one evening/weekend bus to connect Ingram Mill to Battlefield Mall
- Implement new Route 17 Walnut Lawn
- Implement new Route 18 Far South
- 4 additional heavy-duty vehicles
- 6 additional minibuses

Service Improvements

Far South Side Service – Route 11 and 16

Springfield's south side needs additional service, but there is no easy solution to improve east-west ridership on the two corridors that are served by Route 11. The Sunshine corridor has high auto traffic volumes, but it is not well served by transit. Connections with north-south routes are critical for easy movement between routes, but only one north-south route is an easy anchor for the Route 11 transfers. The 60 minute intervals on Route 11 make it difficult for good transfer connections and the one way routing make it difficult to make round trips in a reasonable amount of time. This route in its current structure and configuration is not conducive to serving a significant volume of work trips.

Similarly, the Battlefield corridor has some transit supportive areas, poor connections to other routes, and low frequency of service. Passenger traffic in this area will be relatively low compared to other routes because this is a stand-alone route with very limited passenger traffic to and from other routes.

The Ingram Mill area would benefit from more direct routing to activity centers on the south side. The current routing is circuitous and typically requires at least one hour of travel time for relatively short trips. A simple grocery shopping trip requires a minimum of two hours of time. For example, a passenger traveling from Ingram Mill to Dillon's on Sunshine will travel by bus for 53 minutes to the grocery store, have one hour to shop, and travel 7 minutes to return home. The walking time for the trip to the grocery store is only 34 minutes and some people may prefer to walk to the store and return home by bus when they have their groceries.

The preferred option for service improvement would be to have two terminals split the current route into two pieces and make the new routes bi-directional. The new Route 11 would operate via Sunshine between the two terminals and the new Route 16 would operate via Battlefield between the same two terminals.

The west terminal should be the Walmart on West Sunshine. The east terminal would be a bus stop on Ingram Mill. Buses would be through-routed and operate from Walmart on Route 11 eastbound and then Route 16 westbound. In the other direction, buses would operate via Route 16, then Route 11.

Route 11 would operate eastbound from the Walmart at 3520 Sunshine via Sunshine and Ingram Mill. Westbound buses would use the reverse routing as shown in Figure 89.

Route 16 would operate eastbound from Walmart via Sunshine – Scenic – Seminole – Golden – Battlefield – Stewart – Bartaria - Battlefield Mall bus stop – Battlefield – Ingram Mill as shown in Figure 90. Westbound buses would use the reverse routing.

Figure 89: New Route 11 Routing

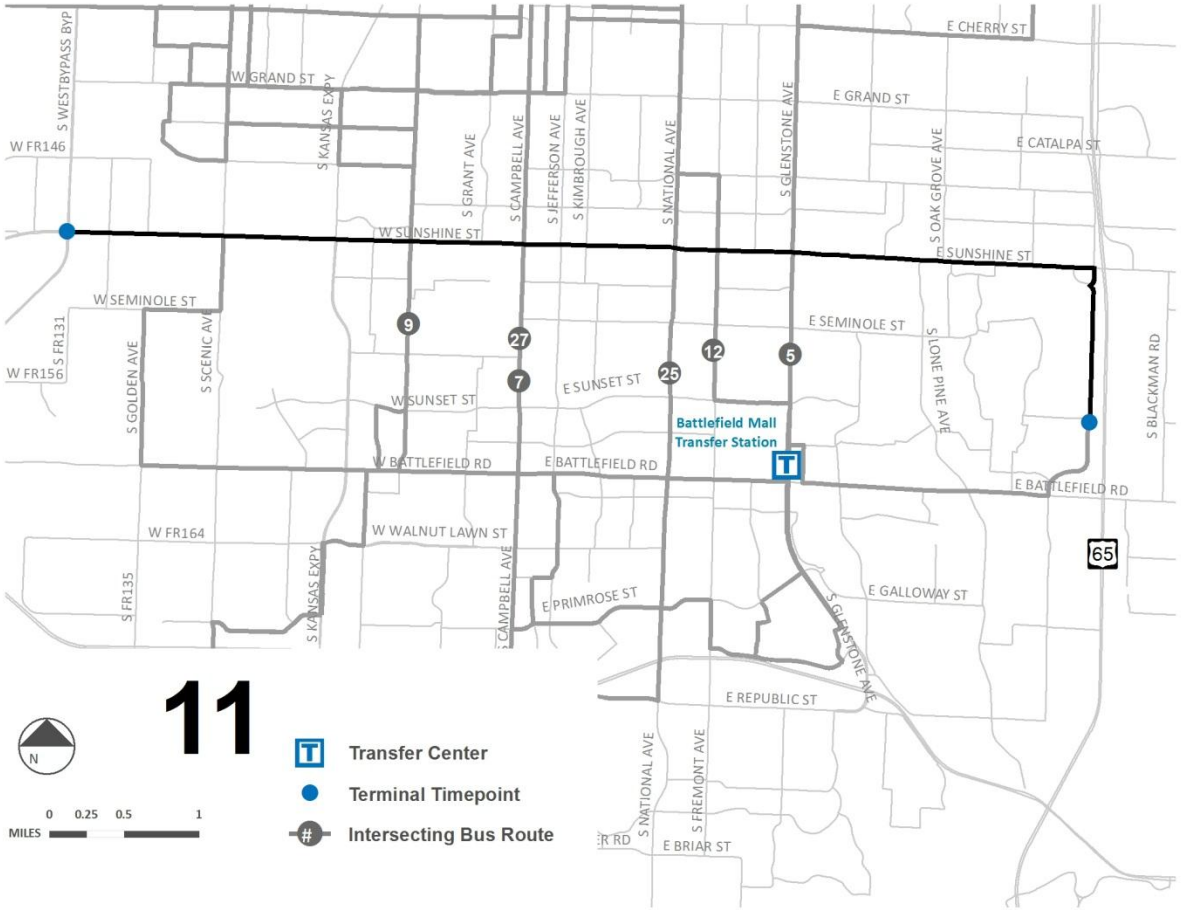
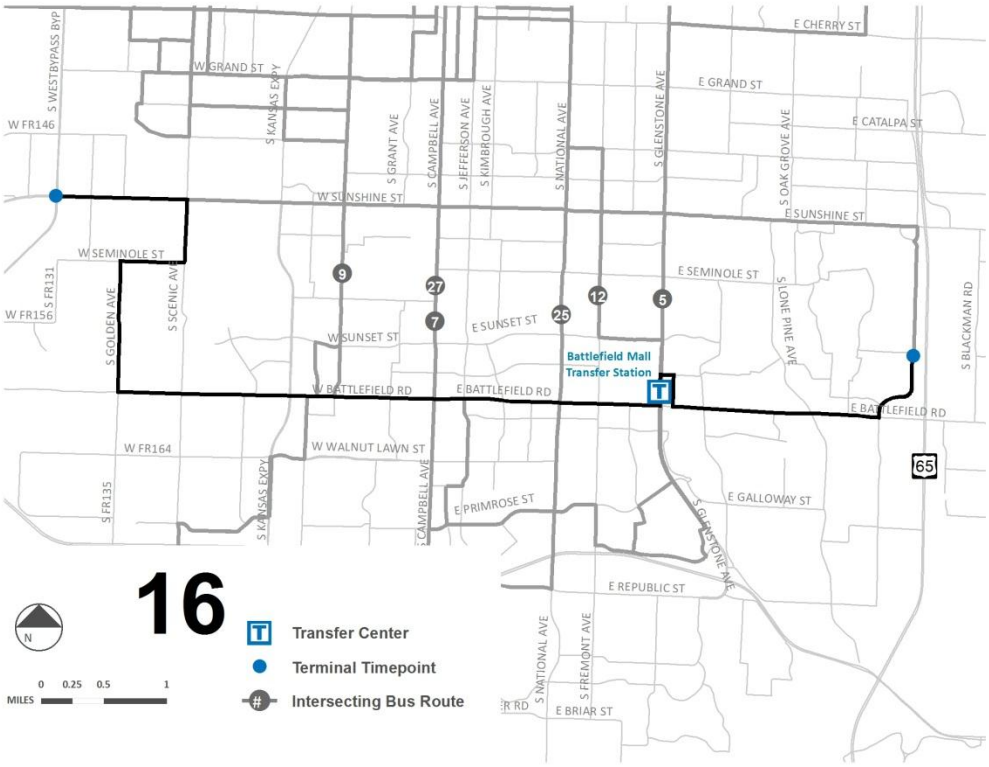


Figure 90: New Route 16 Routing



Buses would operate at a 30 minute frequency on weekdays. On Saturdays the current span of 5 hours would be increased to 11 hours to match the majority of other Saturday service spans and service would be provided at a 60 minute frequency. In the evening and on Sundays, each route would operate at 60 minute frequencies and its schedule would be coordinated with Route 5 as expanded in Level I.

This new route configuration would require a capital investment in four additional buses. Three would be used to add to the current one bus assigned to Route 11 and one would be an additional spare. Ridership would initially be lower than on the other routes improved in the first two levels.

A layover point in each direction on Ingram Mill is required to assure reliable service on the return trip to Walmart. Layover time would be scheduled for approximately five to seven minutes on the east end of the two routes. Two bus turnouts would need to be constructed at a convenient, safe location on Ingram Mill. Adequate pedestrian protection to cross Ingram Mill must be designed into the layover location.

New Springfield Routes

The current CU Transit System provides reasonable area coverage in the City of Springfield. However, there are transit-supportive areas in Springfield's south and southwest areas which could support additional fixed route service. These routes would be similar to some portions of north side routes and provide easier access for residents to local bus service. These would be relatively low-ridership routes and a neighborhood friendly vehicle similar to paratransit type vehicles could be used in these areas. Both routes would connect with the fixed-route system at a convenient transfer point. Service would initially operate at 30 minute peak and 60 minute midday intervals. No weekend or night service would be offered to these new areas.

The two proposed routes would operate as neighborhood circulators. These routes typically operate on residential and collector streets and function to circulate through a neighborhood and connect with the remainder of the transit system at a local node, often a commercial area. With operation on residential streets, it is important that adequate time be worked into the schedule so that buses can operate at safe speeds through residential neighborhoods.

Route 17 would serve areas in Springfield that have the characteristics associated with reasonable transit ridership generally along Walnut Lawn St. This route would complement the north-south routes while facilitating east-west travel in this corridor. With the improved service on Routes 11 and 16, this route would help move the transit system towards more of a grid system.

As shown in Figure 91, Route 17 would leave the Walmart at 2021 E. Independence via Harvard – Independence – Glenstone – Primrose – National - Walnut Lawn - Inman – Scenic – Republic – Golden – Farm Rd 168– Western – Inman – Walnut Lawn and return to Walmart. Careful consideration must be designed into the location and bus stops to insure a safe pedestrian pathway between Route 17 and connecting routes. Schedules should coordinate with Route 7 to facilitate the least travel time from the north side and near south side.

Route 18, as shown in Figure 92, would operate from Library Center to the Walmart at 2021 E. Independence via Campbell – Weaver – National – Lark – Fremont – Holiday – Harvard – Cardinal – Reed – Nature Center Way – Glenstone – Harvard – Independence Walmart. It would return to Library Center via Harvard – Independence – Glenstone and reverse of the eastbound route. Schedule coordination would primarily be with Route 5 at Walmart. Depending on the final route chosen and traffic flow, it may be possible to also have a convenient connection with Route 7 at Library Center.

Figure 91: New Route 17 Routing

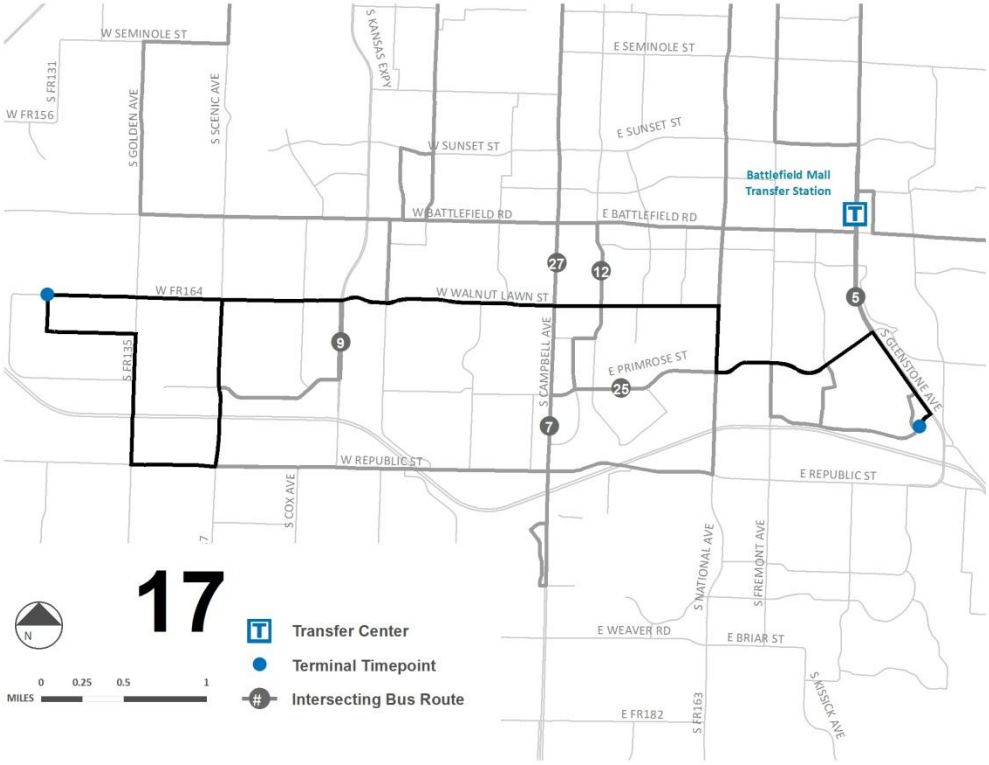
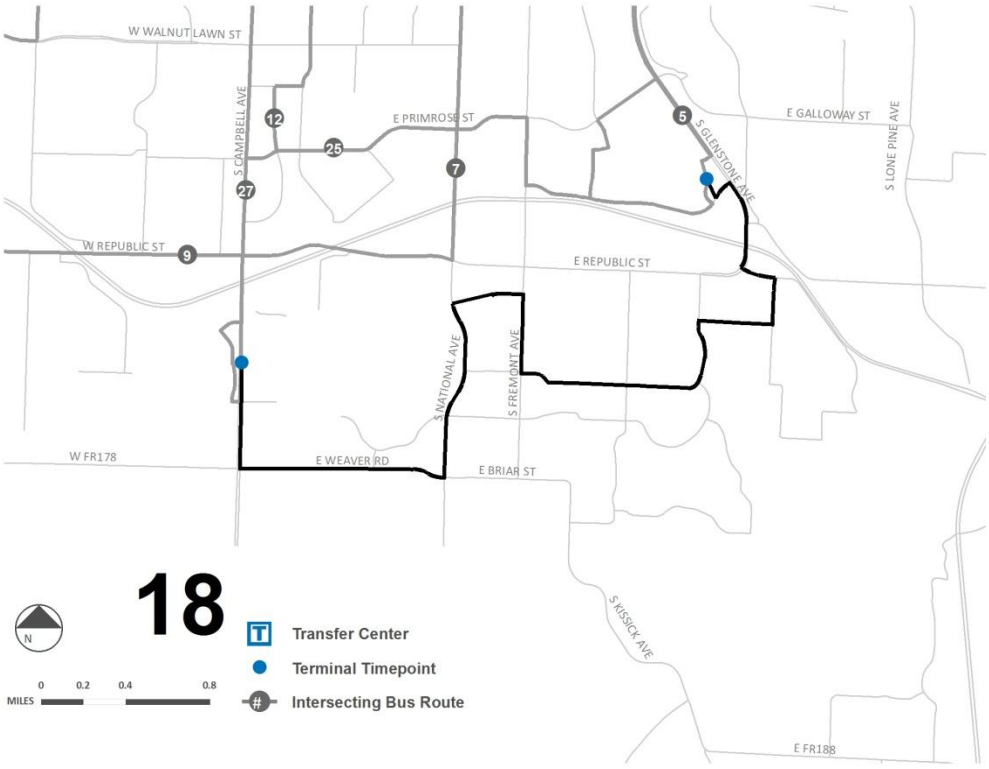


Figure 92: New Route 18 Routing



Overall these areas have moderate ridership potential, but there are pockets of job and residential density that indicate good transit potential. Service should initially be provided at a 30 minute frequency during the a.m. and p.m. peak periods and at a 60 minute frequency during the midday period with a span of service of 12 hours. There would be no evening or weekend service immediately. If the services are successful, additional span of service hours could be added.

Because ridership will likely be lower than other fixed routes, a 25 to 28 foot body on chassis bus, similar to ACCESS buses, could be used for these services. They could be purchased in orders with ACCESS buses, but should have a fixed route package that includes destination signs, standee stanchions, and have a similar paint scheme to the new fixed route buses.

Vehicle Requirements

Five buses will be needed for the new Routes 17 and 18. One spare should also be purchased. If two buses are down for maintenance, then a heavy-duty bus can be substituted. Many bus systems integrate the fixed route body on chassis minibuses and paratransit buses and allow one style of bus to be used on both services. If CU is comfortable with an interior configuration that meets the needs of both fixed route and paratransit customers, the number of spare minibuses can be proportional to the total number of body on chassis minibuses in the ACCESS and fixed route fleet.

The fixed route fleet would increase to 45 buses. Six buses could be body on chassis minibuses and the remaining 39 would be heavy-duty buses. If fleet consistency is desired, all buses could be heavy-duty 35-foot buses.

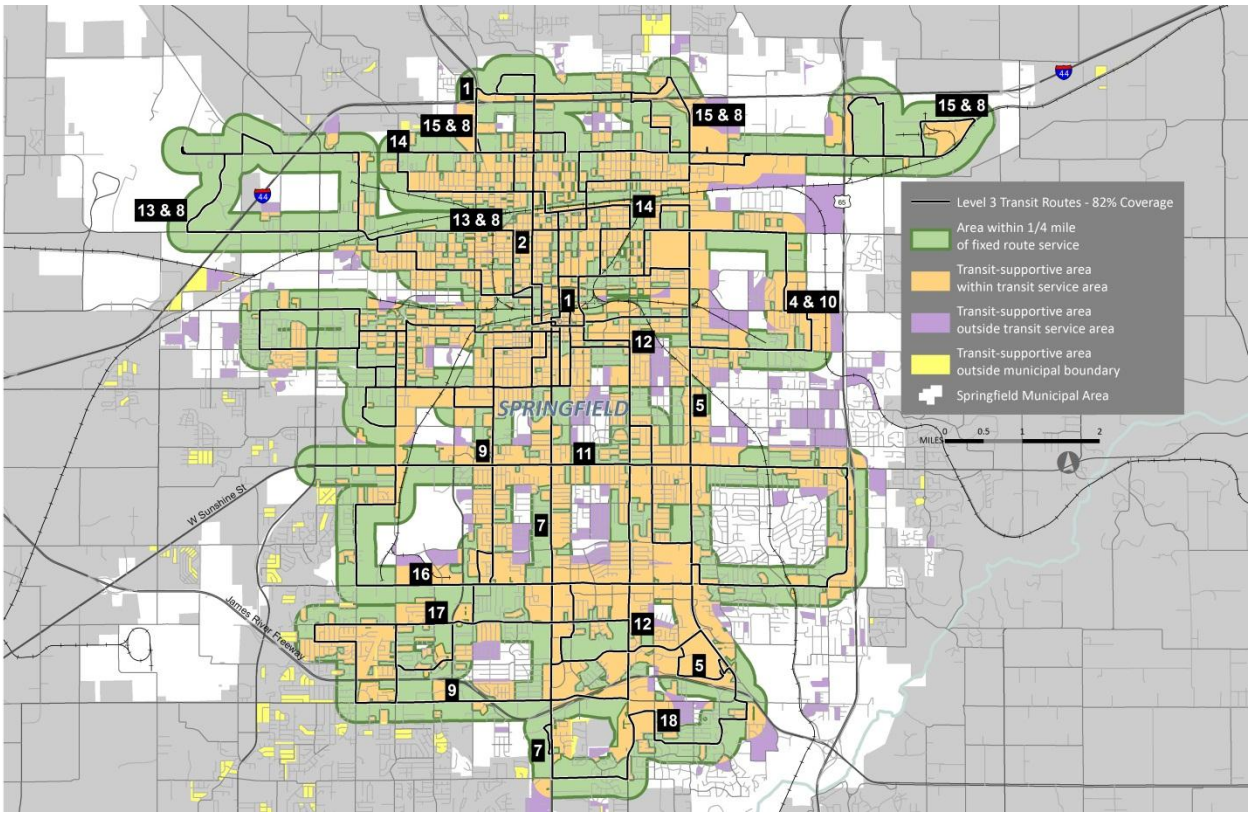
Table 35: Level III Vehicle Requirements

	Peak	Spare	Total
Level II	29	6	35
Level III	37	8	45

System Map and TSA Coverage

The effects of Level III improvements on the overall weekday system map are shown in Figure 93. The additional Level III routes will increase the TSA service coverage from 79 to 82 percent.

Figure 93: Level III Weekday System Map and TSA Coverage



Summary of Level III Improvements

The Level III improvements provide greater area coverage and more frequent service to address the east-west travel patterns on the south side.

Because the Route 17 and 18 will be similar to the existing Route 11 in terms of type of service provided and relative regional location, the new ridership on these routes was estimated using 13.3 passengers per hour, the current value for service on the existing Route 11. The ridership on new Routes 11 and 16 was calculated using the elasticity method. The combined proposed service hours on new Routes 11 and 16 were compared to the service hours on the existing Route 11 to determine the proportional increase. The resulting ridership estimate was then split evenly between new Route 11 and new Route 16. Level III ridership impacts are summarized in Table 36.

Table 36: Level III Ridership Impacts

Route	Level II Passengers	Level II Service Hours	Level III Service Hours	Service Hours % Increase	Passengers % Increase	Level III Additional Passengers	Level III Total Passengers
1/7	302,984	17,384	17,384	0.0%	0.0%	0	302,984
2/12	317,293	16,364	16,364	0.0%	0.0%	0	317,293
4/10	97,782	6,744	6,744	0.0%	0.0%	0	97,782
5	231,021	12,738	12,738	0.0%	0.0%	0	231,021
6	147,933	8,118	8,118	0.0%	0.0%	0	147,933
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
9	97,460	6,744	6,744	0.0%	0.0%	0	97,460
10	-	-	-	-	-	-	-
11	44,284	3,372	9,111	-	-	70,898	115,182
12	37,037	2,367	2,367	0.0%	0.0%	0	37,037
8/13	58,742	3,939	3,939	0.0%	0.0%	0	58,742
14	181,922	8,586	8,586	0.0%	0.0%	0	181,922
8/15	37,494	3,939	3,939	0.0%	0.0%	0	37,494
16	-	-	9,111	-	-	70,898	70,898
17	-	-	6,885	-	-	90,420	90,420
18	-	-	4,590	-	-	60,280	60,280
22	46,908	2,367	2,367	0.0%	0.0%	0	46,908
25	-	-	-	-	-	-	-
26	40,370	2,367	2,367	0.0%	0.0%	0	40,370
27	35,290	2,367	2,367	0.0%	0.0%	0	35,290
Total	**1,676,520**	**97,397**	**123,722**			**292,495**	**1,969,015**

The capital and operational costs associated with Level III improvements are summarized in Table 37, Table 38, and Table 39.

Table 37: Level III Capital Cost Summary

Improvement	One-Time Cost
4 Large Buses @ $400,000 per bus	$1,600,000
6 Minibuses @ $120,000 per bus	$720,000
TOTAL	**$2,320,000**

Table 38: Level III: Operational Cost Summary

Improvement	Annual Cost
Level II Total Operational Costs	$8,765,685
Level III Additional Operational Costs	$2,369,250
TOTAL	**$11,134,935**

Table 39: Level III Service Costs

Level III	Weekday						Mon-Sat Evening					Saturday					Sunday				
Route	Span of Service	Frequency (AM/Mid/PM)	Trips	Cycle Time (AM/Mid/PM)	Service Hours	Peak Buses Required	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq (Peak/ Off-Peak)	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours
1/7	13	20/30/20	32	105/120/120	61.75	6	-	-	-	-	-	12	30/60	18	105	31.5	-	-	-	-	-
2/12	12	20/30/20	30	105/120/120	57.75	6	-	-	-	-	-	12	30/60	18	105	31.5	-	-	-	-	-
4/10	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
5	12	20/30/20	30	60/80/80	37.0	4	5	60	5	60	5	12	30/60	18	60	18	16	60	16	60	16
6	12	20/30/20	30	60	30	3	-	-	-	-	-	12	30/60	18	30	9	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
9	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
11	12	30	24	60	24	2	5	60	5	60	5	12	60	12	60	12	16	60	16	60	16
12	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
8/13	13	60	13	60	13	1	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
14	12	20/30/20	30	60	30	3	-	-	-	-	-	12	30/60	18	60	18	-	-	-	-	-
8/15	13	60	13	60	13	1	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
16	12	30	24	60	24	2	5	60	5	60	5	12	60	12	60	12	16	60	16	60	16
17	12	30/60/30	18	90	27	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	12	30/60/30	18	60	18	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
27	-	-	-	-	-	-	5	60	5	60	5	-	-	-	-	-	16	60	16	60	16
TOTAL					**384**	**37**					**35**					**180**					**112**
					Spare:	**8**															
					Total:	**45**															

AM Peak:	**3 hours**
PM Peak:	**3 hours**
Weekdays / Year:	**255 days**
Saturdays / Year:	**52 days**
Sundays / Year:	**52 days**
Service Cost / Hour:	**90 dollars**

Level II Service Hours:	**97,397**
Level III Service Hours:	**123,722**
Level II to Level III Hours Increase:	**26,325**
Level II to Level III Cost Increase:	**$2,369,250**
Total Level III Annual Cost:	**$11,134,935**

Level IV: Additional Capacity Improvements

The fourth level of investment would provide additional frequency of service on existing routes and incorporate the implementation of limited stop service on some routes. This would provide additional capacity on the existing routes in response to growing ridership as a result of the route and service improvements in the first three investment levels.

Level IV investments would include:

- Limited Stop/Express versions of Routes 5, 7, 12
- 30 minute weekday frequency on Routes 8/13, 8/15
- 30 minute Sunday frequency on routes 5, 12, 22, 26, 27 from 10:00 a.m. to 6:00 p.m.
- 30 minute evening frequency on routes 5, 12, 22, 26, 27
- 12 additional heavy-duty vehicles

Limited Stop Service/Express Service

Limited stop service or express service is often paired with highly used local service to alleviate congestion on the local route and to provide shorter travel times for customers travelling longer distances. Typically these services connect the ends of a route with a central transfer point or other major destination. Often, the routes only stop at transfer locations or major trip generators. For this proposed level of system improvements the most likely candidates for limited stop/express service in Springfield are Routes 5, 7, and 12.

A potential limited stop/express service would be on Route 12 - National. Buses would stop only at Primrose, Battlefield, Sunshine, Grand, one MSU stop to be determined, and Park Central. Travel savings time for customers would be five to seven minutes over the entire length of the route. Average vehicle speed would be similar to auto speeds and this route would have a very time competitive Level of Service for the auto-bus travel time comparison. Frequency of service would be every 30 minutes during peak periods in the morning and afternoon.

Park and Ride lots could be located near these intersections to serve as a collector area for automobiles for passengers desiring to use the limited stop buses or the regular service. No estimate has been made of the cost of park and ride facilities in this analysis. Detailed traffic and pedestrian studies would be needed as part of the park and ride facility development.

This service would be a precursor to Bus Rapid Transit (BRT). Current ridership levels do not justify the investment in BRT. After the investments in Level I, II, and III, a reassessment of the three primary north-south corridors should be made to determine if BRT is appropriate or if the limited stop/express service is the most cost effective solution to meet the mobility needs of Springfield passengers in these corridors. The cost of providing the transit service component of the limited stop/express routes is limited to Level IV improvements to establish the concept, but is not carried through into the Level V improvements.

Additional Frequency Improvements

After the Level II improvements are made and ridership stabilizes, it will become more apparent which routes show the greatest response to the frequency improvements. Detailed analysis of those ridership increases would help to determine which routes should receive further frequency improvements at this stage. Under this proposed level of service, Routes 5, 12, 22, 26, and 27 will be modified to have 30 minute service on evenings and on Sundays from 10:00 a.m. to 6:00 p.m. Routes 8/13 and 8/15 would also be modified to have a 30 minute all-day weekday frequency.

The new evening/weekend Routes 11 and 16 would operate at 60 minute frequencies, but should be evaluated after two years of operation for the potential for frequency improvements. Often, daytime service improvements cause an early evening ridership increase as people make more late afternoon trips that require an evening return trip.

Vehicle Requirements

The limited stop/express service would require an additional 6 buses for operation. The additional frequency improvements would require 4 additional buses. Two spares should also be purchased. This would bring the total fleet requirement up to 57.

Table 40: Level IV Vehicle Requirements

	Peak	Spare	Total
Level III	37	8	45
Level IV	47	10	57

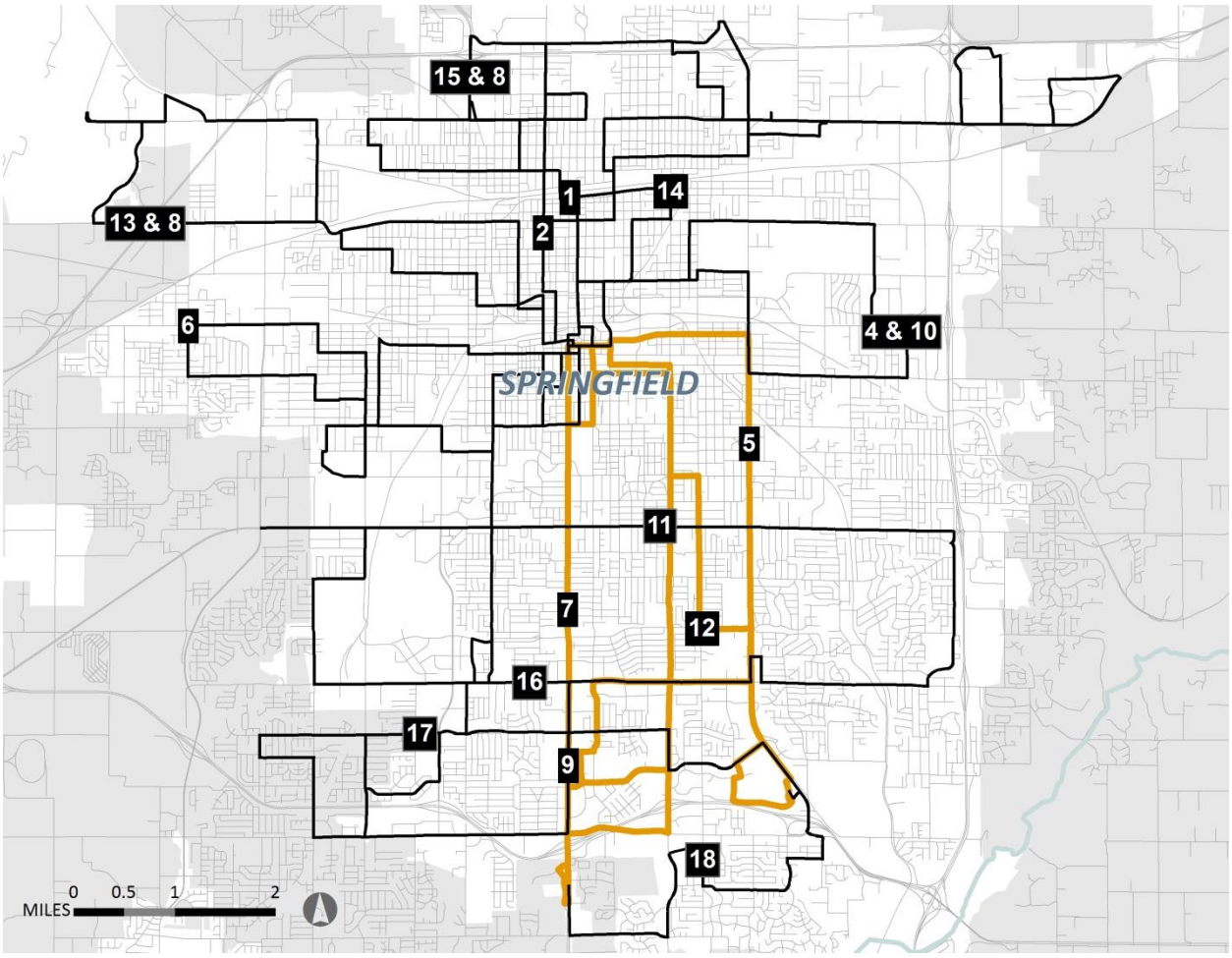
Facilities Study

CU Transit is currently investing in a new maintenance facility that will have a maximum capacity of 40 buses. The improvements detailed in Level IV would greatly exceed the limits of this facility. Given these inherent physical limitations, a facility study would be required at this stage to determine if a second garage should be constructed or if the acquisition cost of nearby commercial and residential property would be more cost effective to house the additional buses required under this service plan.

System Map and TSA coverage

The effects of Level IV improvements on the overall weekday system map are shown in Figure 94. These improvements do not alter the overall route structure of the system, but the locations of the limited stop route improvements to Route 5, 7 and 12 are highlighted in gold. As a result, the level of transit supportive area coverage would not change from the 82 percent coverage resulting from Level III modifications.

Figure 94: Level IV Weekday System Map



Summary of Level IV Improvements

Ridership impacts due to frequency changes were calculated using the elasticity method. For the three new limited stop service routes, ridership was estimated by applying a passengers per service hour value of 20 (the approximate average value for all CU Transit service) to the proposed service hours on these routes. The Level VI ridership impacts are summarized in Table 41.

Table 41: Level IV Ridership Impacts

Route	Level III Passengers	Level III Service Hours	Level IV Service Hours	Service Hours % Increase	Passengers % Increase	Level IV Additional Passengers	Level IV Total Passengers
1/7	302,984	17,384	17,384	0.0%	0.0%	0	302,984
2/12	317,293	16,364	16,364	0.0%	0.0%	0	317,293
4/10	97,782	6,744	6,744	0.0%	0.0%	0	97,782
5	231,021	12,738	14,689	15.3%	7.7%	17,692	248,713
5L	-	-	3,060	-	-	61,200	61,200
6	147,933	8,118	8,118	0.0%	0.0%	0	147,933
7	-	-	-	-	-	-	0
7L	-	-	3,060	-	-	61,200	61,200
8	-	-	-	-	-	-	0
9	97,460	6,744	6,744	0.0%	0.0%	0	97,460
10	-	-	-	-	-	-	0
11	115,182	9,111	9,111	-	-	57,591	172,773
12	37,037	2,367	4,318	82.4%	41.2%	15,264	52,300
12L	-	-	3,060	-	-	61,200	61,200
8/13	58,742	3,939	7,254	84.2%	42.1%	24,718	83,459
14	181,922	8,586	8,586	0.0%	0.0%	0	181,922
8/15	37,494	3,939	7,254	84.2%	42.1%	15,777	53,271
16	70,898	9,111	9,111	-	-	57,591	128,489
17	90,420	6,885	6,885	-	-	0	90,420
18	60,280	4,590	4,590	-	-	0	60,280
22	46,908	2,367	4,318	82.4%	41.2%	19,332	66,240
25	-	-	-	-	-	-	0
26	40,370	2,367	4,318	82.4%	41.2%	16,637	57,007
27	35,290	2,367	4,318	82.4%	41.2%	14,544	49,834
Total	**1,969,015**	**123,722**	**149,287**			**422,746**	**2,391,761**

The capital and operational costs associated with Level IV improvements are shown in Table 42, Table 43, and Table 44.

Table 42: Level IV Capital Cost Summary

Improvement	One-Time Cost
12 Large Buses @ $400,000 per bus	$4,800,000
TOTAL	**$4,800,000**

Table 43: Level IV Operational Cost Summary

Improvement	Annual Cost
Level III Total Operational Costs	$11,134,935
Level IV Additional Operational Costs	$2,300,850
TOTAL	**$13,435,785**

Table 44: Level IV Service Costs

Level IV	Weekday						Mon-Sat Evening					Saturday					Sunday				
Route	Span of Service	Frequency (AM/Mid/PM)	Trips	Cycle Time (AM/Mid/PM)	Service Hours	Peak Buses Required	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq (Peak/ Off-Peak)	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq (Peak/ Off-Peak)	Trips	Cycle Time (min)	Service Hours
1/7	13	20/30/20	32	105/120/120	61.75	6	-	-	-	-	-	12	30/60	18	105	31.5	-	-	-	-	-
2/12	12	20/30/20	30	105/120/120	57.75	6	-	-	-	-	-	12	30/60	18	105	31.5	-	-	-	-	-
4/10	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
5	12	20/30/20	30	60/80/80	37.0	6	5	30	10	60	10	12	30/60	18	60	18	16	30/60	24	60	24
5L	6	30/-/30	12	60	12	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	12	20/30/20	30	60	30	3	-	-	-	-	-	12	30/60	18	30	9	-	-	-	-	-
7	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7L	6	30/-/30	12	60	12	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-
9	12	30	24	60	24	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
10	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-
11	12	30	24	60	24	2	5	60	5	60	5	12	60	12	60	12	16	60	16	60	16
12	-	-	-	-	-	-	5	30	10	60	10	-	-	-	-	-	16	30/60	24	60	24
12L	6	30/-/30	12	60	12	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/13	13	30	26	60	26	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
14	12	20/30/20	30	60	30	3	-	-	-	-	-	12	30/60	18	60	18	-	-	-	-	-
8/15	13	30	26	60	26	2	-	-	-	-	-	12	60	12	60	12	-	-	-	-	-
16	12	30	24	60	24	2	5	60	5	60	5	12	60	12	60	12	16	60	16	60	16
17	12	30/60/30	18	90	27	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	12	30/60/30	18	60	18	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	5	30	10	60	10	-	-	-	-	-	16	30/60	24	60	24
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	5	30	10	60	10	-	-	-	-	-	16	30/60	24	60	24
27	-	-	-	-	-	-	5	30	10	60	10	-	-	-	-	-	16	30/60	24	60	24
TOTAL					**446**	**47**					**60**					**180**					**152**
					Spare:	**10**															
					Total:	**57**															

AM Peak:	**3 hours**
PM Peak:	**3 hours**
Weekdays / Year:	**255 days**
Saturdays / Year:	**52 days**
Sundays / Year:	**52 days**
Service Cost / Hour:	**90 dollars**

Level III Service Hours:	**123,722**
Level IV Service Hours:	**149,287**
Level III to Level IV Hours Increase:	**25,565**
Level III to Level IV Cost Increase:	**$2,300,850**
Total Level IV Annual Cost:	**$13,435,785**

Level V: Highest Level of Service

The final level of investment would produce a very high quality transit service that would make Springfield a national leader in service for cities of similar size. All routes would operate with 15 minute peak service and 30 minute service in the midday.

We believe it would be very difficult to lay out a true grid at ½ mile spacing across Springfield from north to south and east to west without significant breaks in the routes resulting from the current street layout. The simplest way to construct a more grid like pattern would be to keep the basis of the current system in place and add service to complete the desired level of spacing.

It is recommended that the core system remain in place as the area north of downtown currently has very good spacing and there are only a few parts of the community that are lacking the ½ mile spacing. Gaps in the southern portion of the network can be filled with new routes to result in an approximation of a grid with half mile spacing between routes. This keeps the downtown center for current routes in an attempt to construct a workable future network based on today's system and one for which cost and ridership changes can be more easily estimated. This compromise offers the best test of a modified network that represents the principals of grid system given the current shape of the service. The final investments include:

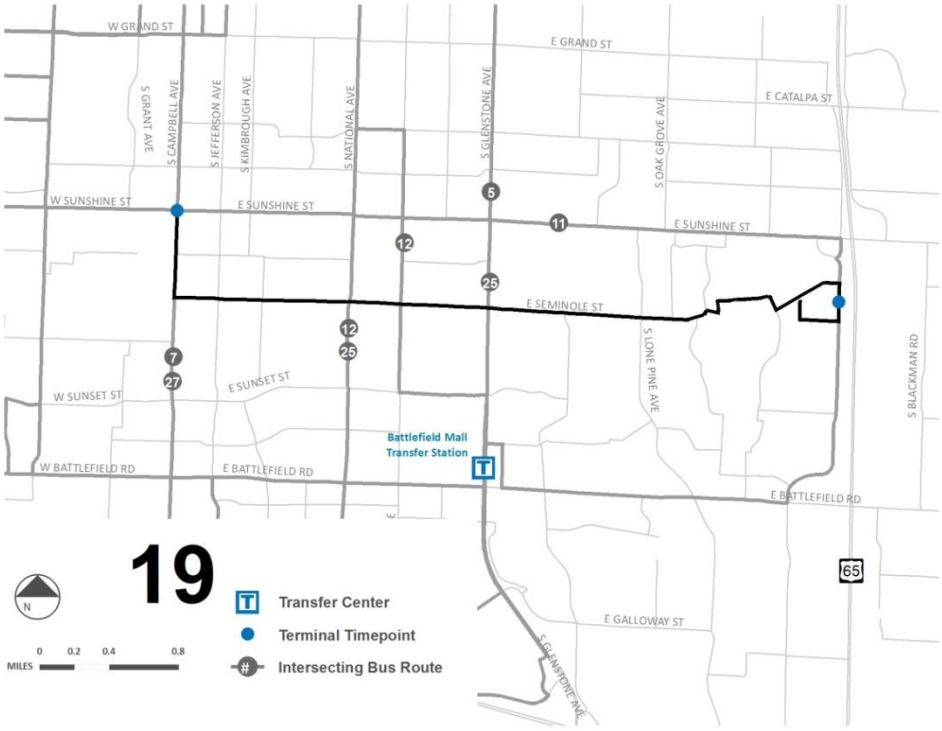
- 15 minute peak, 30 minute midday service on all routes
- 30 minute all day service on Saturday and Sunday
- Two new south side routes
- 20 additional heavy-duty buses
- 14 additional minibuses

New Routes

Two new routes would be created on the south side to provide an approximate route spacing of ½ mile between east-west routes. While other routes have initially started with 30 minute intervals, these two routes would start service with 15 minute peak and 30 minute midday intervals in order to be consistent with the other service improvements in Level V.

Route 19 (Seminole*)* would serve the Seminole corridor and provide another east-west option for south side travel. It would operate from Sunshine/Campbell via Campbell – Seminole to Ingram Mill as shown in Figure 95. The exact routing on the east end depends on a more detailed traffic study of route options and pedestrian movements near the bus stops. Like Routes 17 and 18, the service could be provided by a minibus and designed as a neighborhood circulator service.

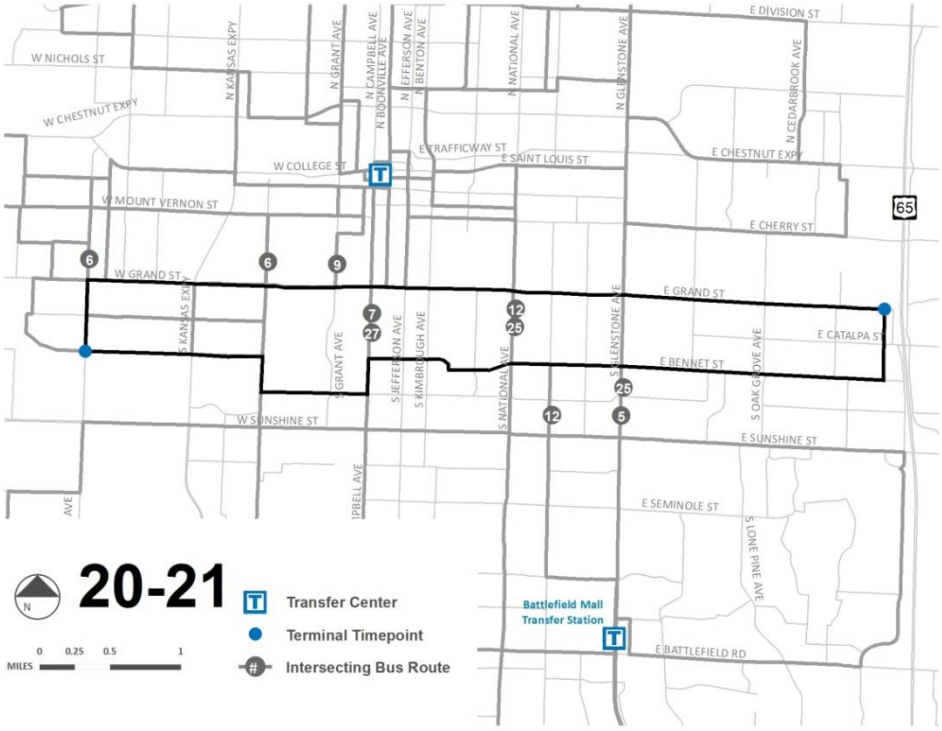
Figure 95: New Route 19 Routing



Route 20/21 (Bennett – Grand) would fill in the remaining corridors where east-west transit needs are currently not adequately served. Initially, it would be a loop route, similar in design and concept to the current Route 11. Portions of the routes have reasonable transit propensity, but there are some areas with low ridership potential. If ridership develops, it can be split into two separate routes as recommended for Route 11. Like Route 19, additional study will be needed to determine safe pedestrian paths near the bus stops. This service could also be provided using body on chassis minibuses.

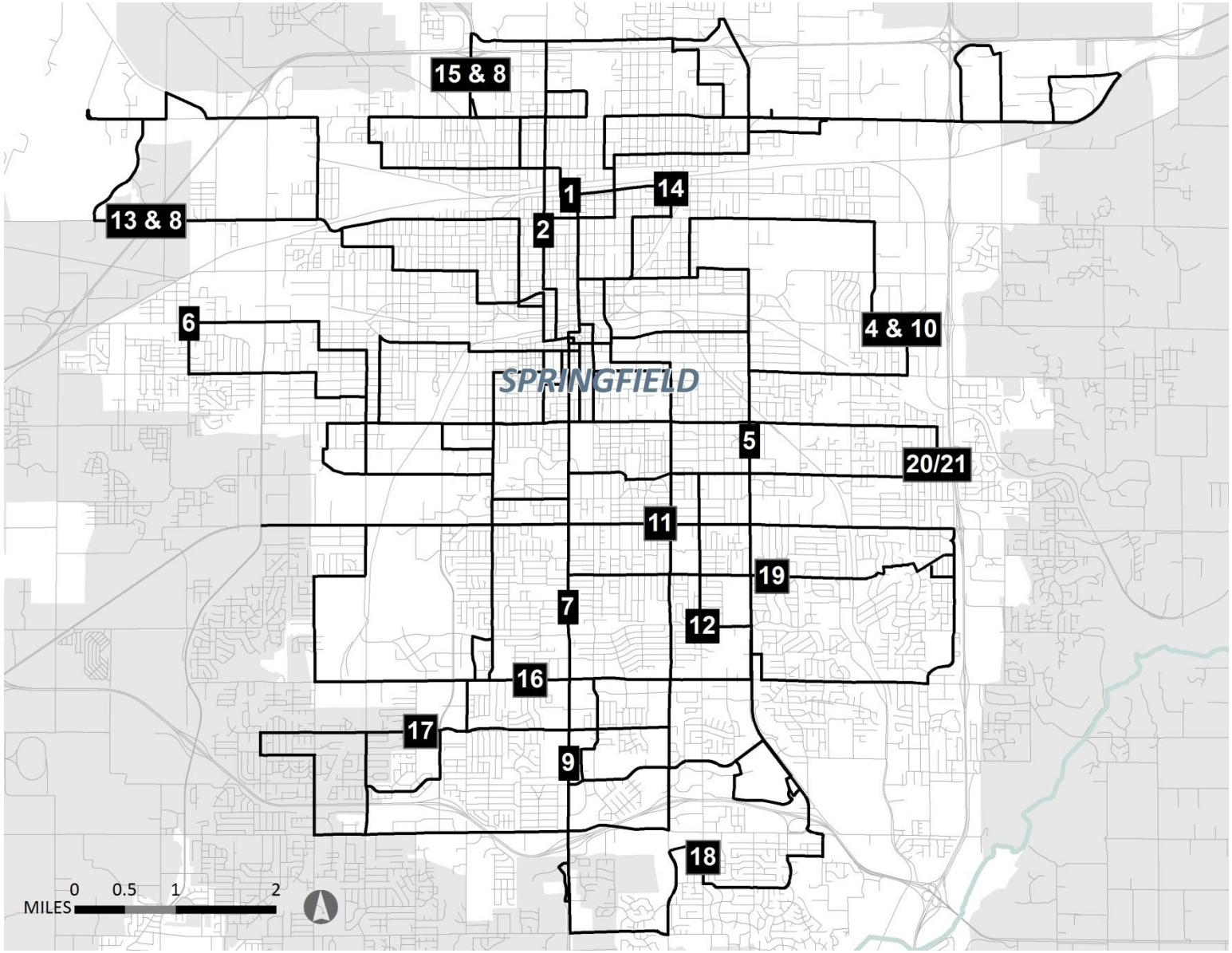
- **Route 20** would operate from Bennett/Scenic via Scenic – Grand – John – Bennett – Campbell – Portland – Fort – Bennett as shown in Figure 96.
- **Route 21** would operate in the reverse direction.

Figure 96: New Route 20/21 Routing



The new routes proposed in Levels III and V would fill gaps in the current route network that do not serve relatively dense areas of Springfield. By implementing these routes, the CU Transit network will more closely achieve an average route spacing of ½-mile. This denser route structure will provide greater access and transportation options to areas of Springfield with transit-supportive population densities. The proposed weekday system map is shown in Figure 97.

Figure 97: Level V System Map



Vehicle Requirements

Routes 19 and 20/21 would require a total of 12 buses for operation. Two buses should also be purchased as spares. Like with Routes 17 and 18 proposed in Level III, these routes could be operated using body on chassis minibuses. The combination of new routes and increased frequencies will result in a fleet requirement of an additional 20 heavy-duty buses.

The fixed route fleet would increase to 91 buses. 20 buses could be body on chassis minibuses and the remaining 71 would be heavy-duty 35-foot buses. If fleet consistency is desired, all buses could be heavy-duty 35-foot buses.

Table 45: Level V Vehicle Requirements

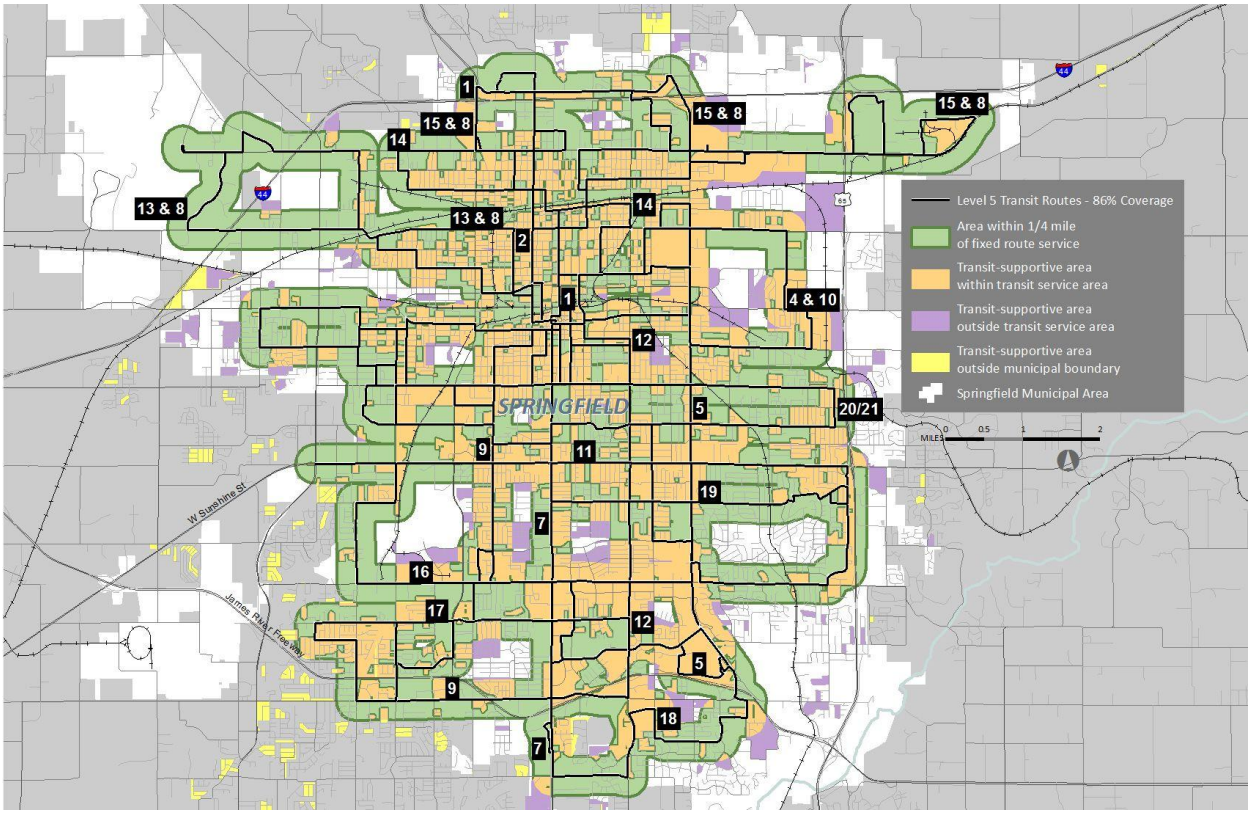
	Peak	Spare	Total
Level IV	47	10	57
Level IV (No Lim/Express)	41	9	50
Level V*	76	15	91

** Does not include limited stop/express routes proposed under Level IV improvements*

System Map and TSA Coverage

The effects of Level V improvements on the overall weekday system map are shown in Figure 98. The additional Level V routes will increase the TSA service coverage to 86 percent.

Figure 98: Level V Weekday System Map and TSA Coverage



Summary of Level V Improvements

Bus service will be provided at high frequencies to a wide variety of customers and meet a wide variety of travel needs within Springfield. The ridership impacts due to Level V improvements are shown in Table 46. As with the new Routes 17 and 18 proposed in Level III, Routes 19 and 20/21 are similar in service type and location to the existing Route 11. Therefore, the ridership on these routes was calculated using 13.3 passengers per service hour, the current productivity level of the existing Route 11. All other ridership changes due to frequency improvements were calculated using the elasticity method.

Table 46: Level V Ridership Impacts

Route	Level IV Passengers	Level IV Service Hours	Level V Service Hours	Service Hours % Increase	Passengers % Increase	Level V Additional Passengers	Level V Total Passengers
1/7	332,793	19,142	19,597	2.4%	1.2%	3,955	336,748
2/12	345,545	19,142	19,597	2.4%	1.2%	4,107	349,652
4/10	97,782	6,182	9,814	58.8%	29.4%	28,724	126,506
5	264,866	15,416	16,040	4.0%	2.0%	5,361	270,227
6	161,994	9,622	9,752	1.4%	0.7%	1,094	163,089
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
9	120,453	9,242	9,814	6.2%	3.1%	3,728	124,181
10	-	-	-	-	-	-	-
11	167,205	8,700	14,340	64.8%	32.4%	54,198	221,403
12	52,198	3,652	4,016	10.0%	5.0%	2,601	54,799
8/13	83,519	6,130	9,710	58.4%	29.2%	24,388	107,907
14	198,415	10,064	10,324	2.6%	1.3%	2,563	200,978
8/15	53,239	6,130	9,710	58.4%	29.2%	15,546	68,786
16	122,921	8,700	14,340	64.8%	32.4%	39,844	162,765
17	91,836	6,885	13,770	100.0%	50.0%	45,918	137,754
18	61,224	4,590	9,180	100.0%	50.0%	30,612	91,836
19	-	-	9,180	-	-	122,448	122,448
20	-	-	9,180	-	-	122,448	122,448
21	-	-	9,180	-	-	122,448	122,448
22	66,110	3,652	4,016	10.0%	5.0%	3,295	69,405
25	-	-	-	-	-	-	-
26	56,896	3,652	4,016	10.0%	5.0%	2,835	59,731
27	49,736	3,652	4,016	10.0%	5.0%	2,479	52,215
Total	**2,326,735**	**144,553**	**209,592**			**638,591**	**2,965,325**

The capital and operational costs associated with Level V improvements are shown in Table 47, Table 48, and Table 49.

Table 47: Level V Capital Cost Summary

Improvement	One-Time Cost
20 Large Buses @ $400,000 per bus	$8,000,000
14 Minibuses @ $120,000 per bus	$1,680,000
TOTAL	**$9,680,000**

Table 48: Level V Operational Cost Summary

Improvement	Annual Cost
Level IV Total Operational Costs	$13,435,785
Level V Additional Operational Costs	$6,408,675
TOTAL	**$19,844,460**

Table 49: Level V Service Costs Summary

Level V	Weekday						Mon-Sat Evening					Saturday					Sunday				
Route	Span of Service	Frequency (AM/Mid/PM)	Trips	Cycle Time (AM/Mid/PM)	Service Hours	Peak Buses Required	Span of Service	Freq	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq (Peak/ Off-Peak)	Trips	Cycle Time (min)	Service Hours	Span of Service	Freq (Peak/ Off-Peak)	Trips	Cycle Time (min)	Service Hours
1/7	13	15/30/15	38	105/120/120	73	8	-	-	-	-	-	12	30	24	105	42	-	-	-	-	-
2/12	12	15/30/15	36	105/120/120	69	8	-	-	-	-	-	12	30	24	105	42	-	-	-	-	-
4/10	12	15/30/15	36	60	36	4	-	-	-	-	-	12	30	24	60	24	-	-	-	-	-
5	12	15/30/15	36	60/80/80	44.0	6	5	30	10	60	10	12	30	24	60	24	16	30	32	60	32
6	12	15/30/15	36	60	36	4	-	-	-	-	-	12	30	24	30	12	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-
9	12	15/30/15	36	60	36	4	-	-	-	-	-	12	30	24	60	24	-	-	-	-	-
10	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-	-	-
11	12	15/30/15	36	60	36	4	5	30	10	60	10	12	30	24	60	24	16	30	32	60	32
12	-	-	-	-	-	-	5	30	10	60	10	-	-	-	-	-	16	30	32	60	32
8/13	13	15/30/15	38	60	38	4	-	-	-	-	-	12	30	24	60	24	-	-	-	-	-
14	12	15/30/15	36	60	36	4	-	-	-	-	-	12	30	24	60	24	-	-	-	-	-
8/15	13	15/30/15	38	60	38	4	-	-	-	-	-	12	30	24	60	24	-	-	-	-	-
16	12	15/30/15	36	60	36	4	5	30	10	60	10	12	30	24	60	24	16	30	32	60	32
17	12	15/30/15	36	90	54	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	12	15/30/15	36	60	36	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	12	15/30/15	36	60	36	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	12	15/30/15	36	60	36	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	12	15/30/15	36	60	36	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	5	30	10	60	10	-	-	-	-	-	16	30	32	60	32
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	5	30	10	60	10	-	-	-	-	-	16	30	32	60	32
27	-	-	-	-	-	-	5	30	10	60	10	-	-	-	-	-	16	30	32	60	32
TOTAL					**676**	**76**					**70**					**288**					**224**
					Spare:	**15**															
					Total:	**91**															

AM Peak:	**3 hours**
PM Peak:	**3 hours**
Weekdays / Year:	**255 days**
Saturdays / Year:	**52 days**
Sundays / Year:	**52 days**
Service Cost / Hour:	**90 dollars**

Level IV Service Hours:	**149,287**
Level V Service Hours:	**220,494**
Level IV to Level V Hours Increase:	**71,208**
Level IV to Level V Cost Increase:	**$6,408,675**
Total Level V Annual Cost:	**$19,844,460**

Summary

The operational and capital costs, fleet requirements, and ridership estimates for the existing baseline service and the five levels of incremental improvement are summarized in Table 50.

The initial Level I improvements represent a 10 percent increase in annual operating costs and would likely result in a 2 percent increase in annual ridership. The relatively low proportional increase in ridership compared to the proportional increase in cost is due to the improvements primarily focusing on reliability of service in the form of lengthened cycle times and increased supervisory staff.

The Level II improvements would represent a 34 percent increase over current operating costs, but yield much more significant estimated ridership gains with a projected 13 percent increase over current levels. If customers respond favorably to the increased frequency of service, ridership could grow quickly over these estimated levels.

Level III improvements continue to improve the amount of projected ridership gains relative to the operating cost increase with a 70 percent increase in cost yielding a 33 percent gain in ridership over current levels, assuming the increased frequencies in Level II did not attract a significant number of new trips. If Level II improvements were successful the ridership estimate in Level III would be very conservative.

Level IV improvements as described in this report would provide the greatest proportional increase in ridership relative to the increase in operating costs. At this level, a 106 percent increase in operating cost would yield a projected 62 percent increase in ridership compared to current levels. If customers do respond more favorably to the increased frequency levels, this ridership estimate will be very conservative.

Level V, representing the ultimate improvement to CU Transit's frequency of service, route spacing, and operational reliability, would require an operating cost increase of 204 percent over current levels, but would result in a projected doubling of current ridership. Level IV improvements also present the largest estimated capital cost expenditure for implementation. This high cost is entirely due to the nearly 50 percent increase in fleet size required from Level 4 to 5. Given the significant increase in frequency and area coverage, this ridership estimate could also be very conservative.

Table 50: Incremental Service Improvement Summary Table

	Existing	Level I	Level II	Level III	Level IV	Level V
Peak Buses	20	22	29	37	47	76
Spare Buses	5	5	6	8	10	15
Total Buses	25	27	35	45	57	91
Service Hours	72,644	79,983	97,397	123,722	149,287	220,494
Operational Cost	$6,537,915	$7,406,470	$8,765,685	$11,134,935	$13,435,785	$19,844,460
Capital Cost	-	$920,000	$3,200,000	$2,320,000	$4,800,000	$9,680,000
Annual Ridership	1,480,769	1,505,460	1,676,520	1,969,015	2,391,761	2,963,146

Level of Service Analysis

The implementation of these incremental service improvements would have a positive impact on the system Level of Service. The Levels of Service for the existing system and each level in improvement are summarized in Table 51.

Coverage: The existing system currently covers 79 percent of the transit supportive areas in the Springfield area, putting it at a Level of Service B/C. Level I and II improvements would have little to no effect on coverage. Level III improvements would increase the coverage to 82 percent of transit supportive areas in the Springfield area, increasing the Level of Service to B. Level IV would not change the area coverage. Level V would increase the coverage to 86 percent of the transit supportive areas and the Level of Service would remain at B.

Frequency: The majority of service on the existing system operates with a frequency of 30 or 60 minutes, earning a Level of Service D/E. Level I improvement would have no impact on frequency. Level II improvements would increase the average frequency to 20-30 minutes, raising the Level of Service to C/D. Levels III and IV would see no change in this level of service measure. Level V improvements would increase the average frequency to 15-30 minutes. However, this would not be enough to raise the Level of Service grade for frequency.

Travel Time: The existing service currently operates at a Level of Service C for travel time. This equates to a difference between transit and auto travel times for comparable trips of roughly 16-30 minutes. The largest improvement to travel time would be as a result of the implementation of transit signal priority (TSP) in Level I. The implementation of TSP systems has the potential to reduce transit travel times by up to 15 percent. This could potentially raise the Level of Service for travel time to B when limited stop service is implemented under Level IV and to a borderline B/C under the remaining service level scenarios.

Span: The existing system provides an average of 17 hours of service on weekdays, earning a Level of Service B. None of the incremental improvements would have an impact on span of service.

On-Time Performance: The existing service operates at a Level of Service B for on-time performance. As with travel time, the most significant improvements to on-time performance would be as a result of the Level I improvements. This improvement would primarily be the result of TSP, extended cycle times on some routes, and additional supervisory positions and would likely increase the Level of Service to A/B. No other changes in on-time performance would be expected.

Table 51: Level of Service Impacts

LOS Category	Existing	Level I	Level II	Level III	Level IV	Level V
Coverage	B/C	B/C	B/C	B	B	B
Frequency	D/E	D/E	C/D	C/D	C/D	C/D
Travel Time	C	B/C	B/C	B/C	B	B/C
Span	B	B	B	B	B	B
On-Time Performance	B	A/B	A/B	A/B	A/B	A/B

Level A – Best; Level F –Worst

Performance Measures

The performance of CU Transit can be compared to a selection of national peer systems based on a variety of performance measures. The measures gauge how well local transit service performs against the peer averages for the following objectives:

- **Cost Effectiveness:** - Operating Expense per Passenger
- **Service Efficiency:** - Operating Expense per Service Hour
- **Service Effectiveness:** - Passengers per Service Hour
- **Market Penetration:** - Passengers per Capita
  - Service Hours per Capita
- **Revenue Effectiveness:** - Passenger Revenue per Passenger
  - Passenger Revenue per Operating Expense

Each measure was assigned one of three assessments: 1) Better than average if the measure was above the national peer average, 2) Satisfactory if the measure was worse than the national peer average, but within one standard deviation of the mean, or 3) Unsatisfactory if the measure was worse than the national peer average and not within one standard deviation of the mean.

The changes in each performance measure as a result of the changes in service were evaluated for each Level. Those measures that utilize passenger total should be viewed as extremely conservative estimates as a significant increase in passenger utilization is possible with the frequency changes implemented under Level III. The performance measure values and peer comparisons are summarized in Table 52.

At the existing level of service, the summarized performance measures all fall within the satisfactory range with the exception of operating expense per service hour. All of the measures remain at the existing levels of service for Level I and Level II service changes. At Level III, the service hours per capita measure rises above the peer average. At Level IV, the passengers per capital measure also rises above the peer average. Finally, at Level V, the operating expense per passenger, passengers per service hour, and passenger revenue per operating expense measures fall into the unsatisfactory category while passengers per capital and service hours per capita remain above the peer average.

Table 52: Transit Service Performance Measures and Peer Evaluation

Performance Measure	Existing	Level I	Level II	Level III	Level IV	Level V
Op. Expense per Passenger	$4.70 ▢	$4.78 ▢	$5.23 ▢	$5.66 ▢	$5.62 ▢	$6.70 ▼
Op. Expense per Service Hour	$89.57 ▼	$90.00* ▼	$90.00* ▼	$90.00* ▼	$90.00* ▼	$90.00* ▼
Passengers per Service Hour	19.0 ▢	18.8 ▢	17.2 ▢	15.9 ▢	16.0 ▢	13.4 ▼
Passengers per Capita	9.4 ▢	9.4 ▢	10.5 ▢	12.3 ▢	15.0 ▲	18.6 ▲
Service Hours per Capita	0.5 ▢	0.5 ▢	0.6 ▢	0.8 ▲	0.9 ▲	1.4 ▲
Pass. Rev. per Passenger	$0.59 ▢	$0.59* ▢	$0.59* ▢	$0.59* ▢	$0.59* ▢	$0.59* ▢
Pass. Rev. per Op. Expense	13.0% ▢	12.3% ▢	11.3% ▢	10.4% ▢	10.5% ▢	8.8% ▼

▲ *= Better than peer average*

▢ *= Worse than peer average, but within acceptable range*

▼ *= Worse than peer average and outside of acceptable range*

* *= Assumed Value based on existing conditions*

Appendix A: Driver Comments

Collected from direct meetings in October 2011:

Rt. 1 –	• No comments
Rt. 2 –	• Tight schedule between noon and 600pm • Grant and Division stop should be after the traffic light
Rt. 4 –	• Should be combined with Rt. 10 • Students complain about 60 min interval, long waits for bus
Rt. 5 –	• Long delays at some turnouts, should be abandoned • Transfer from 10 to 5 not guaranteed; people run through traffic to get to bus • Drivers do not use cutouts during Christmas time and on busy days because traffic backs up and can't get out into traffic • Wrong location for turnout at Bennett • Portland/Glenstone and Page/Glenstone SB turnouts in wrong location • Heavy traffic at unexpected times causes delays • Buses up to 20 minutes late in afternoon, trips combined and one bus turns around to get back on schedule
Rt. 6 –	• No comments
Rt. 7 –	• Late in afternoon
Rt. 8 –	• Should be combined with 13 to get people downtown quickly • Rt. 14 transfers on Kearney sometimes work; sometimes do not; hour wait • Sometimes Saturday is busier than weekdays
Rt. 9 –	• Should start earlier in morning
Rt. 10 –	• Should be combined with Rt. 4 to get people downtown instead of going to Walmart • Rt. 5 transfer dangerous for passengers running through traffic
Rt. 11 –	• Change times by 15 minutes either way to make better connections • Needs evening service to Ingram Mill • Needs longer Saturday service
Rt. 12 –	• Tight schedule in afternoon • Should use Hobby Lobby stop instead of Glenstone • Stop on Battlefield too close to National, difficulty in changing lanes • Rt. 7 and Rt. 12 both on Primrose, just need one route
Rt. 13 –	• Should be combined with Rt. 8 • Kansas/Nichols stop on both sides of intersection, buses get trapped because cars will not allow bus to merge
Rt. 14 –	• Route should backtrack • Most passengers ride on south end to OTC and Central HS
Rt. 15 –	• People ride around for half hour while waiting for Rt. 10 • No need for midday service • Stops at 600pm and some people walk to Walmart after that
Rt. 22 –	• No comments
Rt. 25 –	• Overcrowded at night, transfer some people to 27 so there is room for more passengers • Does not accommodate working people due to circular nature of route
Rt. 26 –	• No comments
Rt. 27 –	• Helps out 25 when 25 is overcrowded