



**BUS-ON-SHOULDER PROGRESS REPORT**  
**REPORT TO THE KANSAS DEPARTMENT OF TRANSPORTATION ON THE**  
**FIRST SIX MONTHS OF BUS-ON-SHOULDER OPERATIONS**

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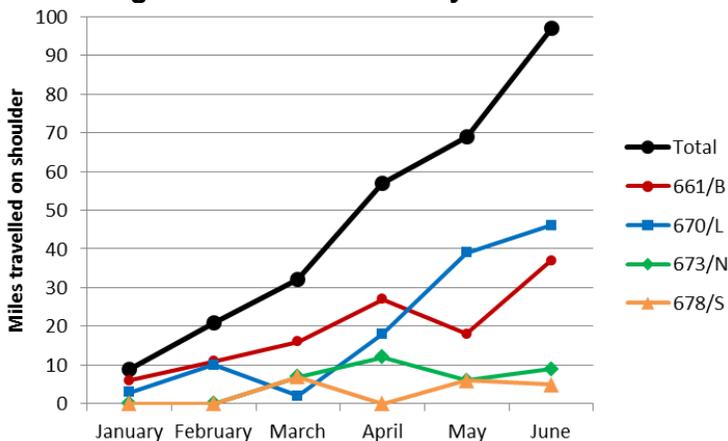
## Executive Summary

On January 3, 2012, Johnson County Transit (JCT) began operating *The JO Xpress*, a modified express transit service on the I-35 corridor that consists of four routes that are allowed to use the right shoulders of an eight-mile segment of I-35 to bypass traffic under specific conditions. The launch of Bus-on-Shoulder (BoS) operations is the result of years of planning and regional coordination. Modifications to the shoulders of I-35 to allow for bus travel were made in FY 2011.

In the first six months of operation, a total of 118 buses used the shoulders of I-35, travelling approximately 285 miles on the shoulder. All four *Xpress* routes have used the shoulder, and shoulder use increased dramatically each month since beginning the service, as shown in **Figure 1**. Additionally, no BoS-related safety incidents have been reported in the first six months of operation.

Ridership increased since BoS operations began in January, as shown in **Table 1**. Ridership on the four *Xpress* routes in the first half of FY 2012 increased by 13.6 percent compared to FY 2011, higher than the solid ridership growth of 9.4 percent for *The JO* system as a whole during the same time period.

**Figure 1: Shoulder Use by Route**



**Table 1: Ridership Trends by Route**

Route	2011	2012	% Change
661/B - Olathe Xpress	34,430	37,555	9.1%
670/L - Gardner-OP Xpress	19,334	22,826	18.1%
671/LN *	477	0	-100.0%
673/N - South OP Xpress	14,465	19,523	35.0%
678/S - Shawnee Xpress	9,412	8,842	-6.1%
<b>Xpress Total</b>	<b>78,118</b>	<b>88,746</b>	<b>13.6%</b>
The JO Other Routes	171,977	184,891	7.5%
The JO Total	250,095	273,637	9.4%

While JCT's initial experience with BoS has been positive, travel time savings is limited due to the relatively short segment where BoS is allowed and the ability to travel only 10 miles per hour faster than mainline traffic. Based on these factors, an analysis of travel time savings reveals that an average of 2.56 minutes is saved each time a bus is able to use the shoulder for at least a two-mile segment. While this assessment is subject to a number of assumptions and data limitations, it does demonstrate that many buses that use the shoulder are able to reduce the impact of traffic congestion on travel time.

An additional four-mile segment in Wyandotte County will significantly improve JCT's ability to further improve travel time. In addition, JCT anticipates further planning efforts for the future expansion of BoS operations, including to the south on I-35 as well as other existing and future transit corridors such as U.S. 69 Highway and I-435.

## Project Overview

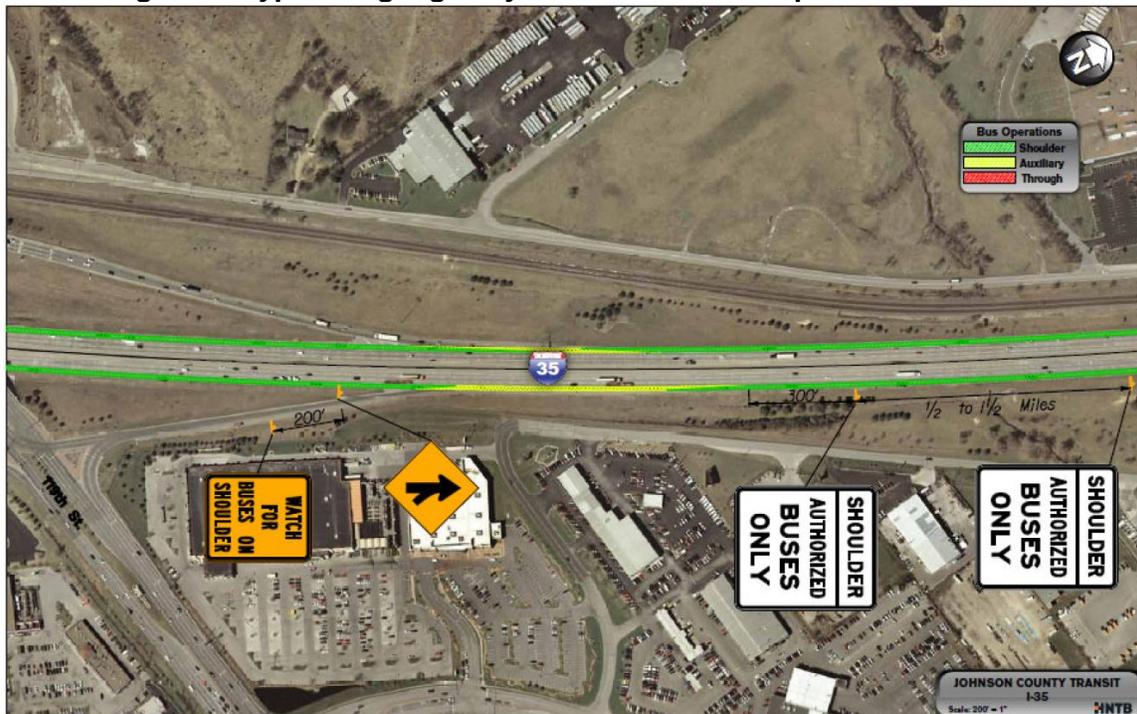
On January 3, 2012, Johnson County Transit (JCT) began operating *The JO Xpress*, a modified express transit service on the I-35 corridor that consists of four routes that are allowed to use the shoulders of I-35 to bypass traffic under specific conditions. These routes include:

- **Route 661/B – Olathe Xpress**
- **Route 670/L – Gardner-OP Xpress**
- **Route 673/N – South OP Xpress**
- **Route 678/S – Shawnee Xpress**

The launch of Bus-on-Shoulder (BoS) operations is the result of years of planning and regional coordination involving JCT, the Kansas Department of Transportation (KDOT), the Kansas Highway Patrol (KHP), and the Mid-America Regional Council (MARC), as well as support from various Johnson County municipalities.

For nearly two decades JCT has looked for ways to enhance transit services, increase transit ridership, and decrease congestion in the Johnson County I-35 corridor. The initial solution was a commuter rail operation on the parallel BNSF railroad track. However, after much debate it became apparent that a new approach was needed. In FY 2007, the *I-35 Fixed Guideway Alternatives Analysis* concluded that BoS was the Locally Preferred Alternative. In FY 2009, JCT completed the *I-35 Fixed Guideway Phased Implementation Plan* which provided a framework for the implementation of BoS service on I-35. This process included outlining the needed improvements on I-35 and developing a conceptual plan for operations and signage (Ref. **Figure 2**).

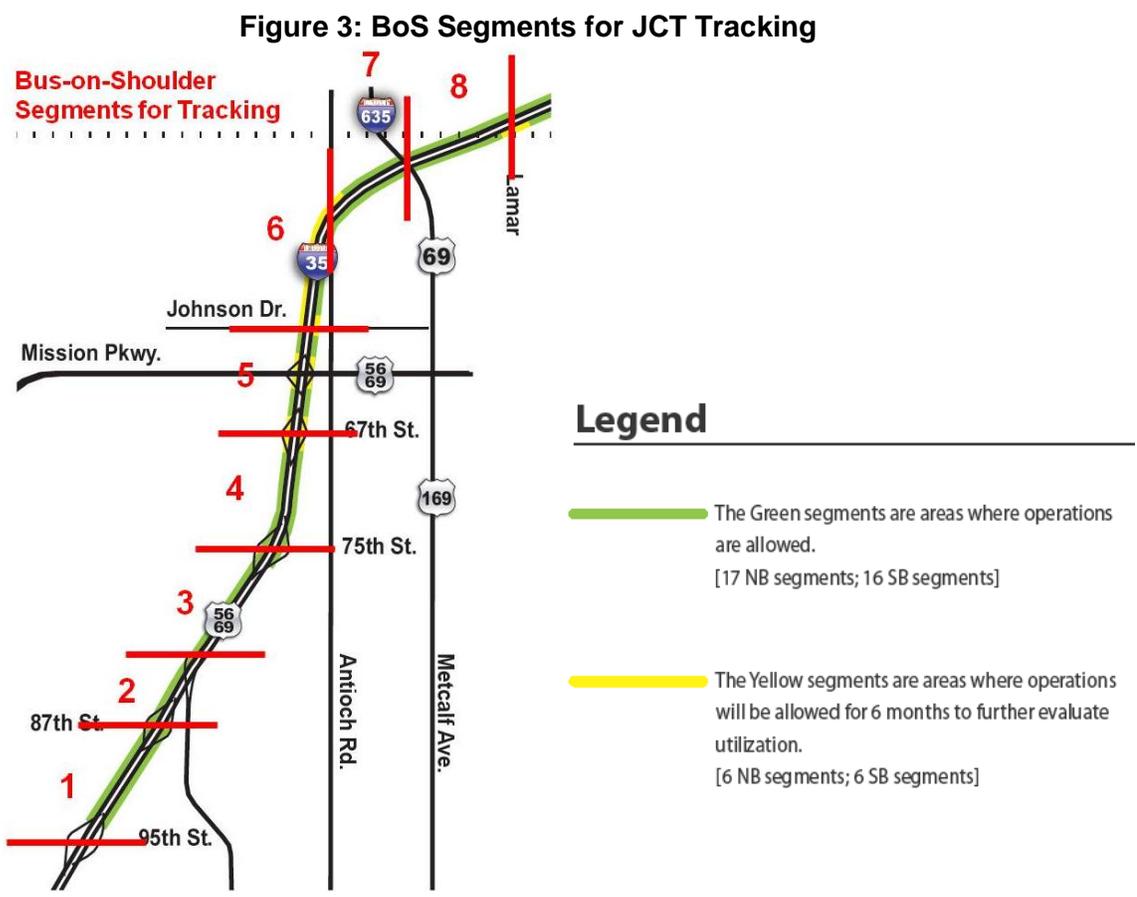
**Figure 2: Typical Signage Layout from Phased Implementation Plan**



Preliminary engineering and service planning activities began in FY 2010 and led to shoulder construction in late FY 2011 and BoS operations in January 2012. Also in FY 2010, JCT received statutory authority from the Kansas Legislature to implement BoS service. K.S.A. 75-5091 allows for the Secretary to “authorize transit buses to be operated upon the right shoulders of city connecting links and other highways in the state highway system in Johnson County.” While the legislative approval does not currently allow for BoS operations in Wyandotte County, shoulder modifications in this portion of the corridor have been designed and JCT anticipates moving forward with this phase of the project in the near future.

Pursuant to the Operations Agreement signed by JCT and KDOT in FY 2011, this report is an overview of the first six months of the I-35 BoS operation in Johnson County.

JCT buses are allowed to use the outside (right) shoulders of I-35 from approximately 95<sup>th</sup> Street to Lamar Avenue in Johnson County. As seen in **Figure 3**, this includes segments where operations are allowed but warrant further evaluation after the first six months of operation (shown in yellow).



In order to track BoS operations, JCT has divided the corridor into the following eight segments, south to north. After each trip, bus drivers track each segment where they use the shoulder. Interchange locations are used to divide each segment in an effort to make it easier for drivers to track their shoulder operation. While the length of each segment varies, the average segment length is approximately one mile. Thus, JCT often reports shoulder use in terms of miles, rather than segments. The segments are as follows:

- 95th Street to 87th Street
- 87th Street to U.S 69 Highway
- U.S. 69 Highway to 75th Street
- 75th Street to 67th Street
- 67th Street to Johnson Drive
- Johnson Drive to Antioch Road
- Antioch Road to I-635
- I-635 to Lamar Avenue

JCT has developed a procedure for tracking the time and location of shoulder use. After each trip, the driver marks each segment where the shoulder was used. Some trips may only involve using the shoulders on one segment, while others may use the shoulder for multiple segments. This information is entered into a database where shoulder use can be track by trip, highway segment, and date.

### **Operating Guidelines**

Since safety is the first priority of KDOT, JCT and the Kansas Highway Patrol, the project team studied how BoS operations would be implemented and how BoS would operate in traffic. The established operating guidelines are based on the experience of other regions but tailored to the transportation needs in Johnson County:

- Buses will operate on the shoulder during peak periods when traffic is moving slower than 35 mph. Those peak times are typically in the morning and in the evening rush hours.
- Buses using the shoulder will not travel more than 35 mph and they will not travel more than 10 miles above the speed of traffic. For example, if traffic is moving 20 mph on the highway, the bus would only travel 30 mph on the shoulder.
- Signage will indicate where BoS operations are permitted.
- Buses must always yield to vehicles entering or exiting the highway.
- If there is an obstruction on the shoulder, such as debris, a stalled car, etc., then the bus must re-enter traffic and move around the obstruction.

### **Shoulder Preparation**

In November and December 2011, modifications were made to the shoulders of I-35 to accommodate bus traffic. This work consisted of installing signage, pavement markings, moving sections of guardrail, and replacing drainage inlets.

Shoulder modifications were managed and monitored by KDOT as part of a collaborative effort. Additional shoulder improvements have been studied and designed for the Wyandotte County portion of I-35, but cannot begin construction until legislative authority is granted.

## Marketing and Public Education

An extensive marketing and public relations effort was conducted in support of BoS implementation. In September 2011, three focus groups were held to gather feedback as a precursor to service launch. The information gathered from the focus groups helped to hone the public information message and format of the public education campaign.

Radio advertisements aired 350 times on metro area radio networks from November 2011 to January 2012. In addition to these advertisements, many local media outlets ran stories on the upcoming BoS service in November and December. Three local television stations interviewed JCT staff and included these videos on local newscasts and online. The Kansas City Star also interviewed JCT staff and published two separate articles on BoS service in November. A “media day” event was also held in December to further promote the service, provide interviews, and answer questions.

Two videos were also created to promote the new service; these videos were posted at [www.thejo.com](http://www.thejo.com) and on JCT’s YouTube channel. Through July, *The JO Xpress* long-form video received 1,146 hits on YouTube; the short video received 114 hits.

When drivers were training on the shoulders in December 2011 (with assistance from KDOT and the Kansas Highway Patrol) the KC Scout overhead electronic message boards on the highway notified drivers of this training. Due to the high traffic on I-35, many drivers learned of BOS due to these signs.

JCT staff has also promoted The JO Xpress and BoS operations at various community meetings throughout FY 2011 and the first half of FY 2012. Overall, the public education effort appears to have been successful in generating interest in *The JO Xpress* and in attracting new riders to transit. This effort was also successful in informing the public and drivers on I-35 about BoS operations and what to expect.

## Operations Report

As of the end of June 2012, 55 bus operators have been trained to drive on the shoulders of I-35. This training process began in November 2011 and has included 58 total drivers. The training consisted of both classroom and on-the-road training. In December 2011, bus operators gained experience with driving on the shoulders in a controlled setting in mid-day hours with the assistance of KDOT and the Kansas Highway Patrol.

First Transit, JCT’s operations contractor, reports that drivers are becoming increasingly comfortable with driving on the shoulders and are learning when and where to use the shoulders based on traffic conditions and other considerations. Passenger comments to drivers, dispatch, and other operations staff have been predominately positive and in some cases inquisitive on when and what areas the drivers can or cannot drive on the shoulder.

Road debris and the narrowness of the roadway in some areas have been the primary concerns identified by bus drivers. A process has been put in place for JCT to communicate to KDOT the need for debris removal. It is important that JCT continue to communicate to KDOT when debris removal is required so that this can be done safely and in a timely manner. This is an area of opportunity that would help ensure drivers have a clear path to get on the shoulders more often. Internally, communication between drivers and our safety department will continue to be critical.

Based on drivers' observations, using the shoulders has minimized delays on their routes, generally enabling a trip to only be a few minutes late rather than 20 minutes late, if traffic congestion is severe. Passengers appreciate the initiative of the drivers to use the shoulders safely, demonstrating an effort to keep the bus on time.

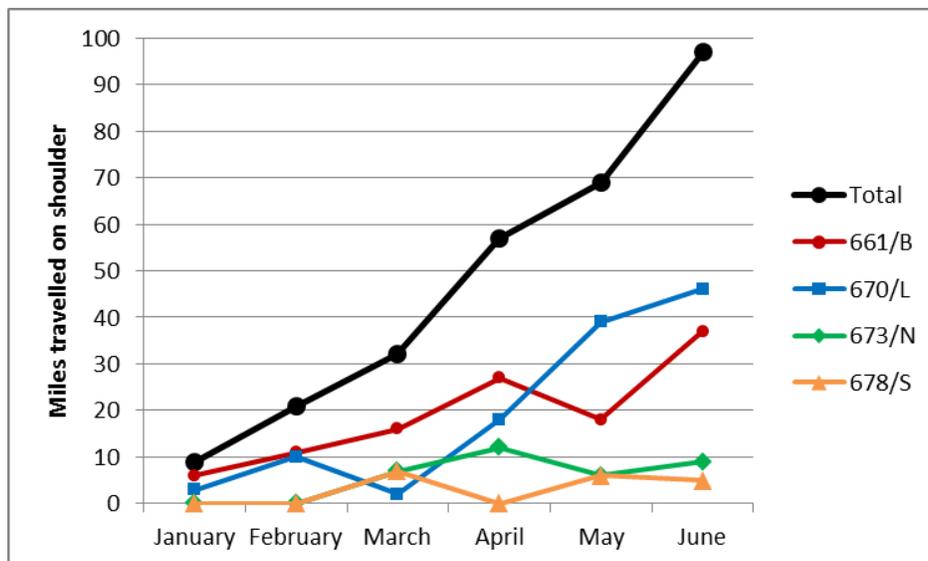
During the first six months of operation, no safety incidents have been reported that can be attributed to BoS operations.

### Shoulder Use

Through the end of June, a total of 118 buses have used the shoulders of I-35, travelling approximately 285 miles on the shoulder (For data collection purposes, JCT has divided the corridor into eight segments; each segment is approximately one mile). All four Xpress routes have used the shoulder during the first six months of operation, and shoulder use has increased each month since beginning the service. **Table 2** shows the increase in shoulder use over the first six months of operation.

**Table 2: Shoulder Use by Route**

Month	# Buses	# of Segments (approximate miles)				
		Total	661/B	670/L	673/N	678/S
January	7	9	6	3	0	0
February	8	21	11	10	0	0
March	13	32	16	2	7	7
April	24	57	27	18	12	0
May	27	69	18	39	6	6
June	39	97	37	46	9	5
Total	118	285	115	118	34	18



JCT buses have used the shoulder more extensively on southbound trips (188 segments) than on northbound trips (97 segments). **Table 3** provides detailed information on the ten trips that have used the shoulder the most in the first six months of operation. Even though eight of the top ten are southbound trips, a **Route 670/L** northbound trip that travels from the highway between 7:51 a.m. and 8:14 a.m. has used the shoulder most frequently.

**Table 3: Shoulder Use by Trip, Direction, and Time**

Route/Run	Direction	Segments	Highway Segment of Trip (Scheduled Timepoints)			
			Start Location & Time		End Location & Time	
670 <u>105</u> -154	Northbound	69	Oak Park Mall P&R	7:51 AM	12th & Washington, KCMO	8:14 AM
661255	Southbound	37	12th & Grand, KCMO	4:43 PM	Strang Line P&R	5:16 PM
661256	Southbound	33	Union Station, KCMO	4:56 PM	Strang Line P&R	5:29 PM
661 <u>252</u> -201-258	Southbound	25	Union Station, KCMO	3:56 PM	Strang Line P&R	4:25 PM
670201- <u>253</u>	Southbound	22	12th & Grand, KCMO	4:08 PM	Oak Park Mall P&R	4:37 PM
678252	Southbound	17	Union Station, KCMO	5:24 PM	Shawnee Station P&R	5:53 PM
673252	Southbound	12	Union Station, KCMO	4:54 PM	137th & Antioch P&R	5:31 PM
673253	Southbound	12	Union Station, KCMO	5:25 PM	138th & Antioch P&R	6:04 PM
670251	Southbound	11	Union Station, KCMO	3:56 PM	Oak Park Mall P&R	4:23 PM
670 <u>103</u> -152	Northbound	9	Oak Park Mall	6:52 AM	12th & Washington, KCMO	7:13 AM

*Note: due to data collection errors, runs that have both northbound and southbound legs are not able to be separated by direction.*

*In these cases, it was assumed that the bus used the shoulder in the direction of the typical heaviest traffic flow.*

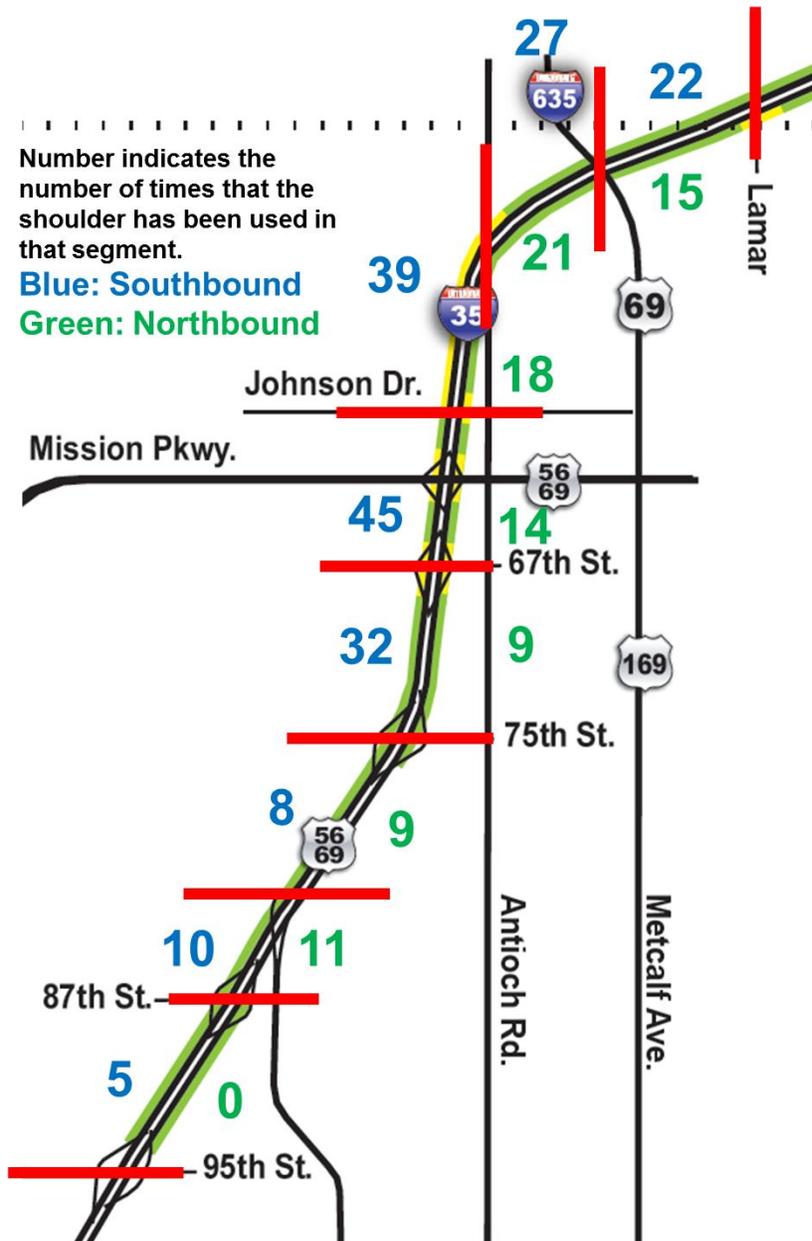
*These trips are underlined in the Run ID numbers. This problem has been corrected for future tracking.*

More than 70 percent of the shoulder use occurred on the northern half of the corridor (between 67<sup>th</sup> Street and Lamar). This is likely due to the following factors:

- All four **Xpress** routes use I-35 north of Shawnee Mission Parkway (**Route 678/S** does not use I-35 south of Shawnee Mission Parkway).
- **Route 673/N** does not use I-35 south of US-69 Highway.
- Traffic congestion is generally higher in the northern portion of the corridor, allowing more opportunity for buses to bypass this congestion.
- Ongoing highway construction between US-69 Highway and 75<sup>th</sup> Street has limited the availability of the shoulder to buses in the northbound direction.

The two southbound segments between Antioch and 67<sup>th</sup> Street were the most used segments of shoulder on the entire corridor. These two segments consist mostly of the “Yellow” segments where operations are to be evaluated after six months of operation. The relatively high use of these segments, with no safety incidents, illustrates that these segments are appropriate for BoS operations. **Figure 4** shows the number of buses that have used the shoulder in the first six months of operation in each of the eight highway segments.

Figure 4: Location and Direction of Shoulder Use



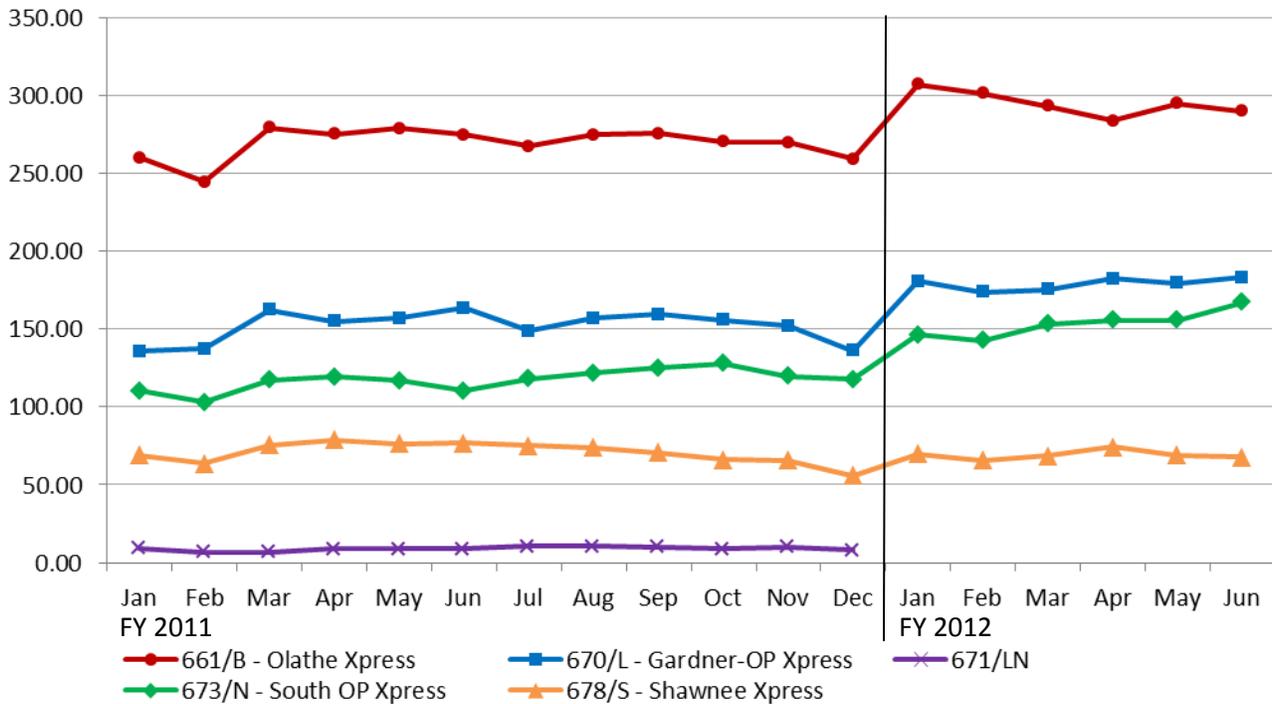
### Ridership

There were a total of 88,746 unlinked trips on the four **Xpress** routes in the first half of FY 2012, an increase of 13.6 percent compared to FY 2011. This ridership growth is larger than **The JO** system as a whole during the same time period (9.4 percent). **Route 673/N** has seen the largest ridership increase of the four **Xpress** routes. **Route 678/S** is the only route where ridership has declined. This route has only two round trips per day and therefore has less capacity for growth. **Table 4** shows the ridership trends for **Xpress** routes.

**Table 4: The JO Xpress Ridership Trends**

Route	2011 (Jan-June)	2012 (Jan-June)	% Change
661/B - Olathe Xpress	34,430	37,555	9.1%
670/L - Gardner-OP Xpress	19,334	22,826	18.1%
671/LN *	477	0	-100.0%
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<b>Xpress Total</b>	<b>78,118</b>	<b>88,746</b>	<b>13.6%</b>
The JO Other Routes	171,977	184,891	7.5%
The JO Total (includes Xpress)	250,095	273,637	9.4%

\* Note: At the beginning of FY 2012, the two **671/LN** trips were consolidated into routes **670/L** and **673/N**



This ridership growth reflects recent system-wide trends and the successful public outreach and marketing efforts that occurred in FY 2011. Unusually warm weather throughout the first quarter of FY 2012 also likely contributed to this growth.

**Customer Comments**

Most of the customer comments that have been received by JCT in the first six months of operation have been related to how often the shoulders are used, rather than identifying specific safety issues. The comments have included:

- There have been 10 recorded complaints that the buses are not using the shoulder often enough, or are not using the shoulder when they should be.

- A few customers have also stated that the project is a waste of money due to lack of shoulder use.
- Two customers have commented that buses should use the left shoulders instead of the right shoulders.

JCT has responded to each comment that has been received. In these responses, JCT staff clarifies that use of the shoulders is at the discretion of the driver. Drivers are well aware of traffic patterns and may decide that using the shoulder will not gain a significant time advantage. Drivers may also be aware of debris, accidents, or other incidents that may not enable use of the shoulders' passengers are often unaware of these situations.

### **Estimated Travel Time Savings**

While JCT is unable to create travel time reports for all trips, a sample of trips that have used the shoulders most often have been selected to provide an estimate of travel time savings resulting from shoulder use. A total of 15 trips that used the shoulder for at least two consecutive segments and for which travel time data was collected have been analyzed to determine the impact of BoS operations. At least one trip from each of the four Xpress routes was included in this analysis. Only the "highway segment" portion of each trip was analyzed.

There are several significant methodology limitations that impact these estimates:

- Since travel time data is provided in whole minutes, calculations are subject to rounding errors. (e.g. a 7:15 a.m. arrival time could actually be 7:15:59 a.m. and affect further calculations)
- Shoulder segments for tracking purposes are assumed to be one mile, and the bus is assumed to have travelled on the shoulder for the entire segment.
- A bus that used the shoulder is assumed to have travelled 10 mph faster than it would have without the ability to use the shoulder (for the distance that the shoulder was used). Obviously, the bus may be travelling less than 10 mph than adjacent traffic in some cases. However, if the traffic is sitting still for a significant length of time, a bus travelling 10 mph would actually achieve an advantage of more than 10 mph. This analysis is unable to account for these factors; thus, an average of 10 mph was assumed.

This analysis reveals that the average time savings for the sample of 15 buses that used the shoulder was 2.56 minutes. The bus that saved the most time was a **Route 673/N** southbound trip on March 23 that traveled an estimated seven miles on the shoulder, and saved five minutes on the highway segment of the trip. This particular trip was already 13 minutes late prior to getting on the highway. Using the shoulder helped this bus not lose additional time while on the highway, as it arrived to 137<sup>th</sup> & Antioch 13 minutes late. See **Table 5** for complete statistics. Using this analysis, the total time savings due to BoS operations is estimated to be 3.3 hours of travel time.

**Table 5: Trips Selected for Travel Time Analysis**

Date	Trip	Total Miles	BoS Miles	Scheduled speed (mph)	Actual speed (mph)	Speed if no BoS (mph)	Total Time Savings (minutes)
2/24/2012	661252	18.5	5.0	38.28	31.71	29.01	3
2/24/2012	670251	14.3	5.0	31.78	28.60	25.10	4
2/27/2012	670105	14.3	3.0	37.30	39.00	36.90	1
3/7/2012	678252	13.1	2.0	27.10	31.44	29.91	1
3/8/2012	678252	13.1	3.0	27.10	26.20	23.91	3
3/22/2012	661256	18.5	2.0	33.64	24.13	23.05	2
3/23/2012	673253	19.8	7.0	30.46	30.46	26.93	5
3/23/2012	661256	18.5	2.0	33.64	21.76	20.68	3
4/4/2012	670105	14.3	2.0	37.30	30.64	29.24	1
4/11/2012	670105	14.3	4.0	37.30	31.78	28.98	3
5/3/2012	673253	19.8	4.0	30.46	34.94	32.92	2
5/11/2012	661255	18.5	3.0	33.64	38.28	36.65	1
5/22/2012	661255	18.5	3.0	33.64	33.64	32.01	2
6/4/2012	673252	19.8	4.0	32.11	33.94	31.92	2
6/20/2012	670105	14.3	6.0	37.30	30.64	26.45	4
<b>Total</b>		<b>249.6</b>	<b>55.0</b>				<b>38</b>
<b>Average</b>		<b>16.6</b>	<b>3.7</b>	<b>33.40</b>	<b>31.14</b>	<b>28.91</b>	<b>2.56</b>

*Note: speed calculations are based on the distance and scheduled time of the last timepoint before entering the highway and the first timepoint after exiting the highway. Buses often travel several minutes and miles between the highway and the timepoint, thus reducing average speeds.*

- Trips that were behind schedule before highway segment: 11 of 15 (73%)
- Trips that were behind schedule after highway segment: 15 of 15 (100%)
- Trips that did not lose additional time while on highway: 7 of 15 (47%)

While using the shoulder does not generally turn a late trip into an on-time trip, for nearly half of the trips analyzed, the bus was able to maintain the schedule that it was on prior to getting on the highway. Two modifications to BoS service could improve travel time savings: increasing the length of BoS-eligible shoulders or increasing the allowed speed differential beyond 10 miles per hour.

While not included in this analysis, schedule and routing adjustments have led to additional travel time savings. Also in January 2012, JCT modified the route alignment for **Xpress** routes in downtown Kansas City, saving an additional four to six minutes on each trip.

### **Xpress Transit Stations**

The implementation of BoS operations has always been intended to be accompanied by improvements to transit stations along the Xpress routes. While this process has lagged behind the implementation of BoS operations, these stations are tentatively planned for construction in the fall of FY 2012, to be complete by the end of the year or the first quarter of FY 2013. JCT has selected a contractor for the project, and the station designs are currently under review by

the cities of Olathe and Overland Park. A rendering of these stations are shown in **Figure 5**. The stations will be located at the following Park & Ride locations:

- Strang Line Park & Ride (Heartland Church)
- Great Mall Park & Ride
- Sheridan & Kenwood Park & Ride (Mid-America Nazarene University)
- 137<sup>th</sup> & Antioch Park & Ride (Palazzo 16 Theatre)
- 151<sup>st</sup> & Antioch Park & Ride (Blue Valley Baptist Church)

Additional locations may be improved at a later date, including a Park & Ride location in Gardner as well as “basic bus stops” along the routes.

**Figure 5: The JO Xpress Transit Station Rendering**



## **Future Planning**

While JCT’s initial experience with BoS has been positive, travel time savings is fairly limited due to the relatively short segment where BoS is allowed and the ability to travel only 10 miles per hour faster than mainline traffic. The proposed (and designed) four-mile segment in Wyandotte County will greatly improve JCT’s ability to maintain schedules. This segment is the most congested and presents the most opportunity for shoulder use. Legislative approval for this segment should be sought in FY 2013. In addition, while state legislation is being revisited, consideration should be given to increasing the allowable speed differential to 15 miles per hour (as allowed in Minneapolis BoS operations).

Future BoS phases should also be considered south of the existing segment, perhaps extending to 119<sup>th</sup> Street, where Route 661/B enters/exits the highway. The I-35 and I-435 interchange presents a challenge in this portion of the corridor. Segments as far south as 151<sup>st</sup> Street could also be considered for shoulder use, especially since shoulders in this portion of the corridor tend to be wider and would require fewer modifications. However, this segment of I-35 is currently only used by one Xpress route and generally has lower traffic congestion. After I-35 crosses into Missouri on the north end of the corridor, BoS is not feasible in the near-term due to this segment of the highway being nearly all bridge structure and having shoulders that are not wide enough for bus use. However, future planning for the improvement of I-35 in Missouri should give consideration to BoS or other dedicated lanes for bus and high-occupancy-vehicle use.

Phase II of the *Fixed Guideway Implementation Plan* is anticipated to outline these future steps of BoS operations on I-35. Future planning efforts should also explore the feasibility of implementing BoS in the following corridors:

- US-69 Highway between I-35 and 135<sup>th</sup> Street.
- K-10 Highway in Johnson and Douglas counties.
- I-435 between K-10 Highway and Quivira Road, potentially extending to other portions of the corridor in the long-term.