



# Memo

To: Myles O'Keefe (LYNX)  
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Date: Monday, February 04, 2019  
CC: Jessica Alvarez, David Miller – Foursquare ITP  
Jane Lim-Yap, Mary Raulerson (Kittelson)  
**Re: Limited Stop Bus Alternatives for SR 436**

## Background

Earlier this year, LYNX considered submitting an application to the Florida Department of Transportation (FDOT) for a service development grant to fund the capital cost and operational expenses of limited-stop bus (LSB) service on SR 436. LSB had been identified in the [LYNX SR 436 Transit Corridor Study](#) as a short-term alternative worth advancing with local or state funds.

The service development grant application proposed to add 30-minute LSB service from the Orlando International Airport (OIA) to SR 434. This alignment corresponds to the entire length of the corridor study's study area. The application estimated a \$6M annual operating expense, half of which needed to be covered by local matching funds. Although the proposed LSB service was positively received by local stakeholders, no matching funds were identified and the application was not submitted.

This memorandum serves as a first step to update the service development grant application for the next cycle. To increase the chances of success, the team proposes to do the following:

- Reduce the annual operating cost of the proposed LSB service
- Highlight the cost-effectiveness of LSB service when compared to simply adding local service
- Position LSB service as a precursor to the long-term premium transit alternative resulting from the corridor study. LSB is seen to help educate/introduce users to a different transit service that would allow for faster travel times but have fewer stops. This will also help build ridership and familiarity on what potential premium transit can offer.
- Emphasize direct connection to SunRail from some of the densest areas of Orange and Seminole Counties
- Provide easy-to-digest information and ample time for local stakeholders to secure matching funds



## Alternatives

To illustrate opportunities for LSB service along the SR 436 corridor, the project team developed three LSB alternatives and one local bus alternative. All alternatives share the same alignment: OIA to the Altamonte Springs SunRail station (“SunRail”), mimicking the long-term Alternative B BRT identified in the SR 436 Study.

The LSB alternatives share the same underlying local bus service—an extension of Link 436S from Fern Park SuperStop to SunRail. Link 436S with the extension to SunRail is labeled “436S+”, while LSB service is labeled “FastLink 412” in the succeeding discussions. To lower the cost of implementing LSB service, two of the alternatives contemplate reductions in Link 436S frequency or span of service. These alternatives are summarized in Table 1.

For each of the alternatives, this memo summarizes their service pattern, cost, and pros and cons. Table 2 and Table 3 provide summaries of the cost and pros/cons of the alternatives, respectively. Note that benefits common to all LSB alternatives are not described in Table 3 to avoid repetition. LSB benefits across all alternatives include:

- Providing users with a choice between faster travel or minimizing walking
- Creating a direct connection to SunRail from some of the densest areas of Orange and Seminole Counties
- Lowering the effective headways for SR 436 travelers
- Serving as a precursor to the long-term premium transit alternative

Relevant parameters used to generate these estimates are described in the methodology section of the memorandum. Once a short-term alternative is chosen for advancement, informational materials on the alternative should be developed to share with local stakeholders and the general public.

Table 1 | Description of Short-Term Alternatives

Case	Description
<b>No LSB: 436S+ local service at 15-minute headways</b>	Doubles the frequency of local 436S service and extends it to SunRail. No LSB service. This scenario serves as comparison point, as increasing frequency is what is traditionally done to improve service on a high-demand corridor.
<b>Alternative 1: Limited Stop Bus at Peak Periods, and 436S+</b>	LSB service from 6AM to 9AM and 3PM to 6PM every 30 minutes on weekdays. No change to Link 436S+ span or frequency <sup>1</sup> .
<b>Alternative 2: Limited Stop Bus, Reduced Local Service Frequencies, and 436S+</b>	LSB service all-day on weekdays, Saturdays and Sundays every 20 and 40 minutes on the hour, with 436S+ service every hour.
<b>Alternative 3: Limited Stop Bus, Reduced Local Service Span, 436S+</b>	LSB service all-day on weekdays, Saturdays, and Sundays every 30 minutes. 436S+ service every 30 minutes from 5:30 AM to 7:30 PM on weekdays and Saturdays and no Sunday service.

<sup>1</sup> Existing Link 436S span of service varies between 17 and 18.5 hours. Existing Link 436S frequency varies between one and two buses per hour (i.e., 60-minute and 30-minute headways).

Table 2 | Revenue Hours and Costs: Base Case and Short-Term Alternatives

Case	Rev. Hours	Rev. Hours Δ (%) over Base Case	Annual Cost	Annual Cost Δ (%) over Base Case
<b>Base Case: No change to current local service*</b>	35,000	---	\$2,600,000	---
<b>No LSB: 436S+ local service at 15-minute headways</b>	65,000	+29,000 (+82%)	\$4,800,000	\$2,200,000 (+82%)
<b>Alternative 1: Limited Stop Bus at Peak Periods and 436S+ local service</b>	50,000	+15,000 (+42%)	\$3,700,000	+\$1,100,000 (+42%)
<b>Alternative 2: Limited Stop Bus, Reduced Local Service Frequencies, and 436S+</b>	57,000	+22,000 (+61%)	\$4,200,000	+\$1,600,000 (+61%)
<b>Alternative 3: Limited Stop Bus, Reduced Local Service Span, and 436S+</b>	60,000	+24,000 (+69%)	\$4,400,000	+\$1,800,000 (+69%)

\* Although not shown here, increased ridership or congestion could result in slower transit runtimes. This would mean that new buses and more operators would be needed to maintain service at current levels.

Table 3 | Pros and Cons: Short-Term Alternatives

Case	Pros	Cons
<b>No LSB: 436S+ local service at 15-minute headways</b>	<ul style="list-style-type: none"> <li>▪ Simplest alternative, would be easiest to communicate to public and stakeholders</li> <li>▪ Does not require separate branding</li> </ul>	<ul style="list-style-type: none"> <li>▪ Highest operating cost of alternatives</li> <li>▪ Does not prepare riders or stakeholders for long-term premium transit alternative</li> <li>▪ Does not provide riders with choice for faster service</li> </ul>
<b>Alternative 1: Limited Stop Bus at Peak Periods and 436S+ local service</b>	<ul style="list-style-type: none"> <li>▪ Operates at most productive times for transit service</li> <li>▪ No change to existing local service span or frequency</li> <li>▪ Fits existing FastLink brand</li> <li>▪ Lowest operating cost of alternatives</li> </ul>	<ul style="list-style-type: none"> <li>▪ Peak-hour only service is slower and thus costlier to operate on a per-hour basis</li> <li>▪ LSB would not serve off-peak riders, which are the majority on the SR 436 corridor</li> </ul>
<b>Alternative 2: Limited Stop Bus, Reduced Local Service Frequencies, and 436S+</b>	<ul style="list-style-type: none"> <li>▪ Provides LSB service throughout the day and on weekends</li> <li>▪ Runs earlier in the morning and later at night when compared to existing local service</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reductions to local bus frequency may affect transit-dependent populations.</li> <li>▪ Use of LSB service in early mornings, late nights, and weekends less likely to realize travel time gains</li> <li>▪ Estimates from TBEST show that this alternative would reduce the total ridership on the corridor</li> </ul>
<b>Alternative 3: Limited Stop Bus, Reduced Local Service Span, and 436S+</b>	<ul style="list-style-type: none"> <li>▪ Provides LSB service throughout the day and on weekends</li> <li>▪ Runs earlier in the morning and later at night when compared to existing local service</li> </ul>	<ul style="list-style-type: none"> <li>▪ Highest cost of the LSB alternatives</li> <li>▪ Reductions to local bus span in early mornings, late nights and Sunday may affect transit-dependent populations</li> <li>▪ Use of LSB service in early mornings, late nights, and weekends less likely to realize travel time gains</li> <li>▪ Unique local – limited service pattern may require new branding</li> </ul>

## Methodology

The source data and assumptions for this analysis are an important factor in the results obtained. Key characteristics of the alternatives are described below.

**Alignments:** To align termini between the proposed LSB services and Link 436S, each alternative also proposes to extend Link 436S from its current northern terminus at the Fern Park Super Stop to Altamonte Springs SunRail Station. As a result, 436S will no longer deviate from SR 436 to stop at Fern Park, though Links 436N, 102, and 103 will continue to do so. Riders transferring to these routes would need to walk to the nearest stop that is served by these routes. This configuration results in a slight overlap of 436S and 436N service between Altamonte Springs SunRail Station and Fern Park SuperStop. Further evaluation of the appropriate service pattern for Link 436S service will be necessary, but the change to the alignment has little bearing on the cost of the services proposed. Local service now labeled 436S+ to highlight the change in alignment.

**Stops:** LSB service would stop at the BRT station locations identified as part of the SR 436 Transit Corridor Study. Local bus service would continue to use existing stops.

**Running Times:** LSB travel times were developed using the same Foursquare ITP tools used to develop BRT speed and travel time estimates for the SR 436 Transit Corridor Study. Because these LSB travel times are based on actual SR 436 runtimes from LYNX automatic vehicle locator (AVL) data, rather than scheduled travel times, 436S local bus speeds have also been modified to use AVL-derived speeds. 436S local bus speeds have been modified from LYNX-provided Remix files to reflect AVL speed averages in each time period (AM Peak, Midday, PM Peak, Night). As a result, 436S schedule times shown in the Remix links in this memo do not match posted schedules. Overall, this methodological choice promotes comparability between the base case, Link 436S, and LSB revenue hours and costs.

Further specification of running time estimates in Remix may result in more accurate cost estimates. For instance, the AVL data used to generate 436S runtimes reflects a deviation to the Fern Park SuperStop that is not assumed in the extension of 436S to SunRail. However, this difference is estimated to be only two minutes, a small fraction of overall runtime. LSB and Link 436S+ service as shown in Remix should be considered a high-level approximation of future service; unlike BRT alternatives evaluated elsewhere on the project, LSB and Link 436S+ operations plans and GTFS have not been developed yet. As a result, the Remix-derived schedules may not be optimal from an operations perspective.

Table 4 | Running Times: SR 436 Local Service

Segment Times (mins)	AM Peak		Off-peak		PM Peak		Night	
	NB	SB	NB	SB	NB	SB	NB	SB
OIA - Gatlin	15	20	17	19	20	19	14	17
Gatlin - Curry Ford	12	9	13	10	14	9	11	7
Curry Ford - Colonial	9	11	10	12	10	13	7	9
Colonial - University	11	8	11	8	12	8	9	6
University - US 17/92	24	20	23	21	24	24	17	16
US 17/92 - SunRail	7	13	7	12	7	14	6	10
	78	81	81	82	87	87	64	65

Table 5 | Speeds: SR 436 Local Service

Segment Characteristics	AM Peak	Off-Peak	PM Peak	Night
<b>436S to Fern Park</b>				
Distance	34.92	34.92	34.92	34.92
Running Time	139.3	143.6	152.7	112.4
Average Speed (entered in Remix in Base Case)	<b>15.0</b>	<b>14.6</b>	<b>13.7</b>	<b>18.6</b>
<b>436S to SunRail</b>				
Round Trip Distance	36.52	36.52	36.52	36.52
Round Trip Running Time	159.4	162.3	174.4	128.1
Average Speed (entered in Remix in Alternatives)	<b>13.7</b>	<b>13.5</b>	<b>12.6</b>	<b>17.1</b>

Table 6 | Running Times: SR 436 Limited Stop Bus

Segment Times (mins)	AM Peak		Off-peak		PM Peak		Night	
	NB	SB	NB	SB	NB	SB	NB	SB
OIA - Gatlin	13	14	12	13	15	15	12	12
Gatlin - Curry Ford	9	8	8	8	10	8	8	7
Curry Ford - Colonial	10	10	9	9	10	10	9	9
Colonial - University	9	10	8	8	11	10	8	8
University - US 17/92	21	21	19	19	21	22	19	18
US 17/92 - SunRail	6	8	7	8	7	8	7	8
	68	71	63	65	74	73	63	62

Table 7 | Speeds: SR 436 Limited Stop Bus

Segment Characteristics	AM Peak	Off-Peak	PM Peak	Night
<b>436S to SunRail</b>				
Round Trip Distance	36.52	36.52	36.52	36.52
Round Trip Running Time	138.0	129.5	146.8	124.0
Average Speed (entered in Remix in Base Case)	<b>15.9</b>	<b>16.9</b>	<b>14.9</b>	<b>17.7</b>

**Annualization:** The most recent LYNX TDP annualized figures using 252 Weekdays, 52 Saturdays and 59 Sundays, which is used here. In contrast, default Remix settings used in other estimates have assumed 255 weekdays, 55 Saturdays, and 55 Sundays.

**Costs:** The recent LYNX TDP estimated Link 436S required 35,865 annual revenue hours service at a cost of \$3,204,895, or an effective cost per revenue hour of \$89.36. Link 436S as used in this Base Case (with AVL-based speeds) requires 35,407 revenue hours a year and assumes an effective cost per hour of \$74.41 based on earlier LYNX guidance. If the higher Link 436S cost per revenue hour found in the TDP was used in these estimates, the base case estimates here would closely match the LYNX TDP (\$3.20 million for TDP and \$3.16 million from Remix). Costs for individual lines in each alternative are shown below.

Table 8 | Costs by Route: Alternative 1: Peak-Only Limited Stop Bus service

Line	Hours / Year	Miles / Year	Cost / Year
<b>436S+</b>	40,958	525,236	\$3,047,702
<b>FastLink 412</b>	9,257	129,924	\$688,847
<b>Total</b>	<b>50,215</b>	<b>655,160</b>	<b>\$3,736,549</b>

Table 9 | Costs by Route: Alternative 2: Limited Stop Bus Service with Reduced Local Bus Frequency

Line	Hours / Year	Miles / Year	Cost / Year
<b>436S+</b>	23,451	298,055	\$1,744,960
<b>FastLink 412</b>	33,611	511,475	\$2,500,961
<b>Total</b>	<b>57,062</b>	<b>809,530</b>	<b>\$4,245,921</b>

Table 10 | Costs by Route: Limited Stop Bus Service with Reduced Local Bus Span of Service

Line	Hours / Year	Miles / Year	Cost / Year
<b>436S+</b>	25,573	317,340	\$1,902,913
<b>FastLink 412</b>	34,169	520,098	\$2,542,493
<b>Total</b>	<b>59,742</b>	<b>837,438</b>	<b>\$4,445,406</b>

**Spans of Service:** Link 436S operates two patterns of service, one of which is a set of short-runs early on Weekday and Saturday mornings; moreover, spans of service differ slightly by direction. Rather than replicate these patterns of service precisely, the Remix-based estimates here assume a consistent pattern of service in both directions. The start and end of service in the base case and alternatives also differ slightly from existing Link 436S service. However, these differences do not affect relative comparisons of costs.

**Remix:** Cost and service characteristics were generated with Remix:

- Base Case: <https://platform.remix.com/map/3b78b40>
- No LSB: 436S with Doubled Frequency: <https://platform.remix.com/map/ce82479/>
- LSB Alternative 1: <https://platform.remix.com/map/a284030>
- LSB Alternative 2: <https://platform.remix.com/map/6f58371>
- LSB Alternative 3: <https://platform.remix.com/map/4651554>