

## **Appendix C**

### **Metro South MetroLink Extension AA/DEIS: Task VI Operating Plans for Detailed Alternatives (August 2004)**

Metro South MetroLink Extension  
Alternatives Analysis and DEIS

Technical Memorandum

Task VI Draft Operating Plans for  
Detailed Alternatives

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for

East-West Gateway Coordinating Council

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## APPENDICES:

1. Rail Run Times for Alternative Extensions

2. AM Peak Schedules for Alternatives

## 1.0 Introduction

The purpose of this technical memorandum is to describe the operating plans that have been developed for the five detailed build alternatives for the MetroSouth MetroLink extension. These operating plans were the basis for the ridership forecasts and were used to estimate operating and maintenance costs. The methodology and results of that process are discussed in the last chapter of this memorandum.

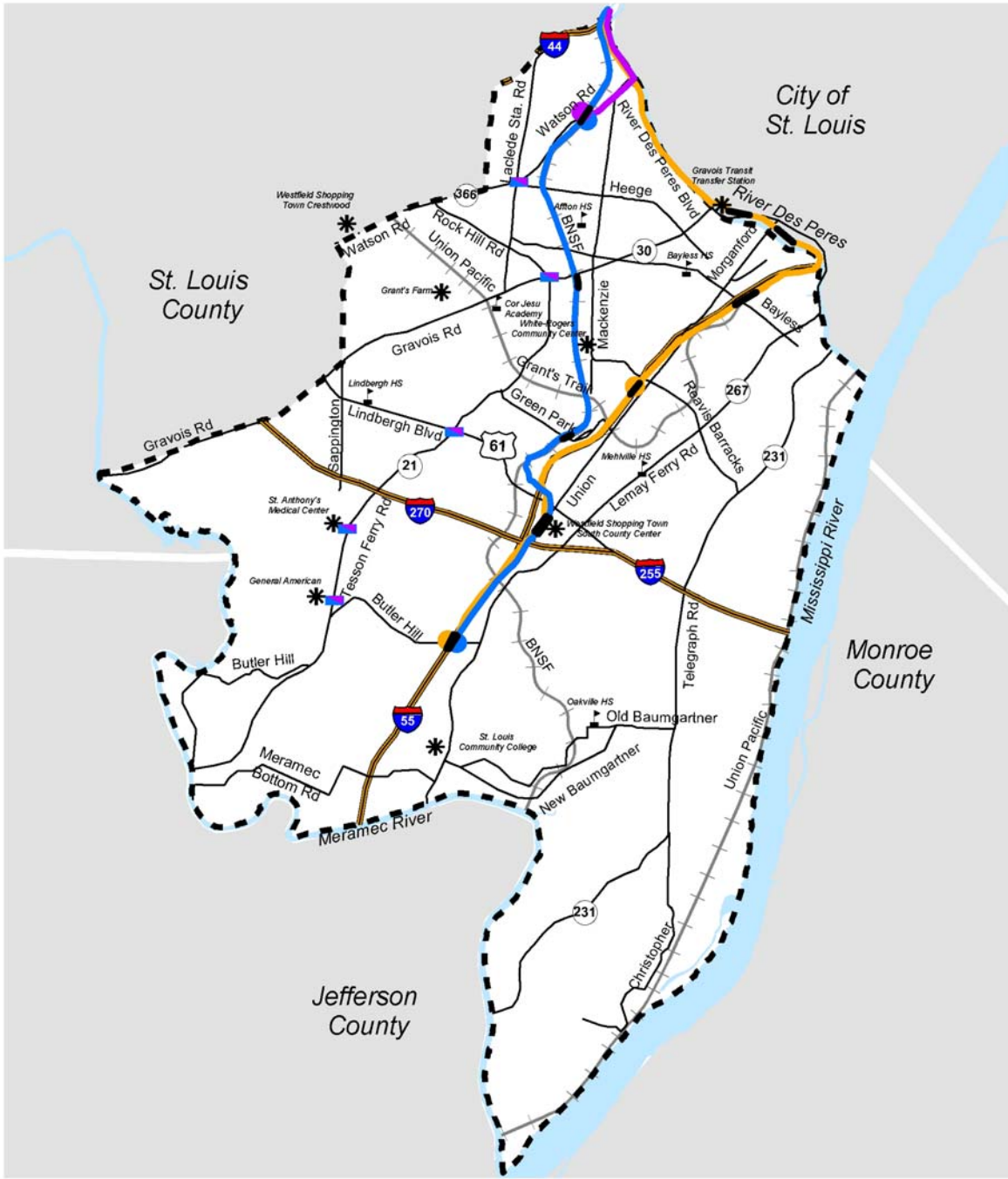
The five detailed build alternatives that were considered are:

- Purple Line to Kenrick
- Blue Line to Butler Hill
- Blue Line to Kenrick
- Orange Line to Butler Hill
- Orange Line to Reavis Barracks

These alternatives are illustrated on the following map. A detailed description of each alternative can be found in the *Definition of Detailed Alternatives Report*.

The light rail operating plans for each alternative are described in Chapter 2, and the feeder bus plans are discussed in Chapter 3. Chapter 4 presents the methodology for estimating operating costs and the resulting estimates.

The Blue Alternative to Kenrick is operationally almost identical to the Purple Alternative. Both alternatives have one new station at the same location at Kenrick Plaza. The only difference is in the rail alignment between Shrewsbury and Kenrick, which affects rail run times by less than 30 seconds. Therefore this report combines some of the description for these two alternatives.



**Metro South MetroLink Extension Alternatives Analysis/DEIS**

Sponsoring Agencies  
 East-West Gateway Coordinating Council  
 Metro  
 Missouri Department of Transportation



- Purple Alternative
- Blue Alternative
- Orange Alternative
- Station (not to scale)
- Possible Terminal Station
- Enhanced Bus Stop
- ▣ Study Area
- Rail Facilities
- Rivers
- Interstate
- Major Roadway
- \* Major Activity Centers
- ⚡ Schools

**Metro South Detailed Alternatives**

## **2.0 Light Rail Operating Plan**

Several steps were followed in the development of rail operating plans, including estimation of running times, calculation of train cycle times, and estimation of fleet size and annual operating statistics. Certain assumptions and methods were used in developing the operating plans. All of these are discussed below.

### **2.1. Assumptions for MetroLink Light Rail Operations**

#### Hours of Operation

On weekdays, the system, either baseline or baseline plus any alternative, commence revenue operation at 3:30 AM and terminate revenue operations at 1:00 AM, the following day. Operating hours on weekdays will therefore total 21.5 hours. Peak period operations, for purpose of LRV (light rail vehicle) train interval, are from 6:00 AM to 9:30 AM, and from 3:45 PM to 6:00 PM, a total of 5 hours 45 minutes per weekday. Off-peak operating hours total 15 hours 45 minutes per weekday.

On Saturdays, Sundays, and holidays, operations commence at 4:30 AM and terminate at 1:00 AM the following day, a total of 20 hours 30 minutes, with no peak periods.

#### LRV train headway

During the peak periods on weekdays, train service headways from each end point is ten minutes, with the headway on the core line segment averaging five minutes. In the off-peak period, train service headway is fifteen minutes, with the headway on the core line segment averaging 7.5 minutes.

On Saturdays, Sundays, and holidays, the train service headway is fifteen minutes from each end point, with the headway on the core segment averaging 7.5 minutes.

#### Train consist

On weekdays all trains are two cars. On weekends/holidays, all trains are a single car.

### **2.2. Rail Running Times**

A total of five Metro South alignment extensions were evaluated using Parsons' *TrackMaster* simulation software. Runtimes for the Purple, Blue (with options ending at Butler Hill and Kenrick Plaza), and Orange (with options ending at Butler Hill and Reavis Barracks) alternatives were developed using Train Performance Calculation simulations, as follows:

#### Detailed Alternative Characteristics

The physical characteristics of each detailed alternative were taken from engineering data prepared by Jacobs that included the alignment extension's grades, curves, speed restrictions, and planned station locations. The data were converted using Visual Basic® programs into the

*TrackMaster* network format, with adjustments for stationing equivalences in the engineering data. Track speeds were set to the project-design Maximum Authorized Speed (MAS) of 55 mph, except where curve restrictions required lower speeds. In sections where the alignment is operating parallel to an existing highway/roadway, operating speeds were limited to the posted speed limit of the paralleling highway/roadway—if the highway/roadway was posted for 35 mph, then the LRV operation was limited to the same speed.

Roadway crossings at grade were identified in the alignment database. Where the light rail alignment was operating on a separate alignment or along the BNSF right of way, grade crossing protection was assumed, and no speed reductions planned. Where the light rail alignment operated at the side of a roadway, signalized intersections were identified and speeds through those crossings reduced to 5 mph to reflect the possible delays from the highway signals and cross traffic.

Each alignment alternative has a different number of station stops along its route. Station “dwells” are standardized at 20-seconds for all station stops.

Existing/Proposed Service

Train run times used herein for the Shrewsbury to Emerson Park service were provided in the report entitled *Cross County MetroLink Extension (Segment I), Rail Operating Plan Options Report, Part 2: Detailed Analysis*, dated May 2001. The existing MetroLink time table was used to determine run times between Lambert Main Terminal and Shiloh/Scott.

Appendix 1 shows the station-to-station distances and run times by direction for each of the five extension alternatives. The total distances and times for the extensions are summarized below.

**Table 2-1: Rail Run Time Summary**

		PURPLE	BLUE	BLUE	ORANGE	ORANGE
		Kenrick	Butler Hill	Kenrick	Butler Hill	Reavis Barracks
Stations		1	5	1	6	4
Alignment	Feet	7,632	58,123	7,386	58,123	36,200
SB Distance	Miles	1.46	8.76	1.42	11.01	6.93
SB running Time		0:03:00	0:14:36	0:02:35	0:22:31	0:15:47
NB Distance	Miles	1.45	8.75	1.40	10.99	6.92
NB Running Time		0:02:50	0:14:21	0:02:27	0:19:10	0:12:31

### **2.3. Baseline Service Patterns**

The baseline system is defined as the existing 38-mile line between Lambert Main Terminal and the Shiloh-Scott station, plus the under-construction 7.7-mile line segment between Shrewsbury – Lansdowne I-44 and Forest Park, the latter station being where this line segment will join the existing system. This rail system is included in both the No-Build and TSM Alternatives.

All trains operating Lambert / Shiloh-Scott service will operate through from end to end: there is no turnback for this service. Peak period headways are 10 minutes, with 15-minute offpeak headways.

Trains originating at the Shrewsbury-Lansdowne I-44 station will turn back at Emerson Park station, serving 11 stations in common with the Lambert / Shiloh-Scott existing service between Forest Park and Emerson Park. These eleven stations are also referred to as the “core” line segment. Shrewsbury-Lansdowne I-44 trains reverse direction on the pocket track immediately east of Emerson Park station. Peak period headways are 10 minutes, with 15-minute offpeak headways. This results in trunk line headways in the core segment of 5 minutes during peak periods and 7.5 minutes offpeak.

### **2.4. Integration with Existing Service**

The principal issues addressed in the integration of alternative extension service with existing service between Lambert Airport and Shiloh-Scott include the following:

1. Provide uniform headways to the extent possible on the core segment between Forest Park and Emerson Park.
2. Provide sufficient access/egress time at the Emerson Park pocket track, while providing sufficient layover time at Emerson Park pocket track so not as to delay a following train's access to the pocket track.
3. Provide sufficient clearance time at Forest Park to preclude delay to either an eastbound train from either Lambert Airport or to a westbound train crossing over to the extension route.
4. Provide a sufficient layover time at the alternative extension terminus.

### **2.5. Detailed Alternative Extensions Operating Plans**

The alternative system extensions beyond Shrewsbury-Lansdowne I-44 are as follows:

1. Purple (Kenrick, 1.5 miles)
2. Blue (Butler Hill, 8.8 miles)
3. Blue (Kenrick, 1.4 miles)
4. Orange (Butler Hill, 11.0 miles)
5. Orange (Reavis Barracks, 6.9 miles)



Alternative extension trains are to operate from their respective terminal stations through to, and turn back at Emerson Park. Table 2-2 contains projections of trips, LRV miles, and LRV vehicle hours for the baseline scenario, and for the baseline scenario plus each alternative extension scenario. Details of the calculations are discussed in subsequent sections and tables.

**Table 2-2: MetroLink System Operating Statistics**

	Baseline System	Baseline System plus increment of:				
		Purple	Blue Butler Hill	Blue Kenrick	Orange Butler Hill	Orange Reavis Bks.
Miles Lambert/Shiloh	38.0	38.0	38.0	38.0	38.0	38.0
Miles Shrewsbury baseline and extensions*	17.4	18.90	26.2	18.85	28.4	24.3
Roundtrip run time Lambert/Shiloh	148.0	148.0	148.0	148.0	148.0	148.0
Roundtrip run time Shrewsbury baseline/ext's	88.0	94.0	116.4	93.0	126.2	112.6
Cycle time Lambert/Shiloh	170.0	170.0	170.0	170.0	170.0	170.0
Cycle time Shrewsbury baseline/extensions	110.0	110.0	140.0	110.0	150.0	130.0
<b>Weekday</b>						
Peak operating hours (10" headway, 5" on core)	5:45	5:45	5:45	5:45	5:45	5:45
Off-peak operating hours (15" headway, 7.5" on core)	15:45	15:45	15:45	15:45	15:45	15:45
Peak LRV roundtrips						
Lambert/Shiloh	34.5	34.5	34.5	34.5	34.5	34.5
Shrewsbury/Emerson Park	34.5	34.5	34.5	34.5	34.5	34.5
Off-peak LRV roundtrips						
Lambert/Shiloh	63	63	63	63	63	63
Shrewsbury/Emerson Park	63	63	63	63	63	63
TOTAL LRV ROUNDTRIPS	195	195	195	195	195	195
Peak vehicle miles						
Lambert/Shiloh	7,645	7,852	8,860	7,845	9,163	8,597
Off-peak vehicle miles	13,961	14,339	16,178	14,326	16,733	15,700
TOTAL VEHICLE MILES	21,606	22,191	25,038	22,172	25,896	24,297
Peak LRV hours						
Lambert/Shiloh	322	322	357	322	368	345
Off-peak LRV hours	588	588	651	588	672	630
TOTAL LRV HOURS	910	910	1,008	910	1,040	975
<b>Weekend/holiday - 15-minute interval</b>						
Operating hours	20:30	20:30	20:30	20:30	20:30	20:30
Total LRV roundtrips	164	164	164	164	164	164
Total LRV miles	9,086	9,332	10,529	9,323	10,890	10,217
Total LRV hours	383	383	424	383	437	410
<b>Annually</b>						
Total LRV roundtrips	67,765	67,765	67,765	67,765	67,765	67,765
Total LRV miles	6,508,946	6,685,181	7,542,858	6,679,307	7,801,336	7,319,627
Total LRV hours	274,143	274,143	303,516	274,143	313,307	293,725
<b>Notes:</b>						
LRV hours based on in-service cycle times, including layover time.						
* Shrewsbury baseline and extensions terminate at Emerson Park pocket track.						

### Trips

Peak-period weekday roundtrips are generated by dividing 5:45 operating hours by peak-period service headway of 10 minutes from two endpoints, e.g. Lambert Main Terminal and Shrewsbury. The result is 34.5 trips for each terminal point.

Off-peak weekday service roundtrips are derived by dividing 15:45 operating hours by 15 minutes, yielding 63.0 round trips for each of the two terminal points. Thus there is a total of 195 (34.5+34.5+63.0+63.0) round trips per weekday. On an annual basis, the weekday total is multiplied by 255 days.

Saturday, Sunday, and holiday roundtrips are derived 20:30 operating hours by 15 minute service interval, resulting in 164.0 roundtrips. On an annual basis, the weekend/holiday total is multiplied by 110 days.

Extension of the service beyond Shrewsbury would not alter the number of trips, but simply extend the time and mileage taken to complete each trip. Non-revenue trips to and from storage and maintenance facilities are not included.

### Cycle Time

Train performance calculations generate run times, reflecting LRV performance over each alternative's profile of grade and speed limits, including the required station stops. Random delays and other operating issues are excluded from these calculations. To the calculated hypothetical roundtrip run time are added a desired layover time at each end of route. The total of run and layover time is the cycle time.

Initial indications are that the 1.5-mile Purple (Kenrick) and the Blue (Kenrick) alternatives can be operated with the same cycle time and vehicle requirements as the Shrewsbury-Lansdowne I-44 baseline (110 minutes), with, of course, a reduction in the layover component of cycle time. Initial indications are that the 8.8-mile Blue (Butler Hill) alternative can be operated with a cycle time of 140 minutes, the 11-mile Orange (Butler Hill) alternative with a cycle time of 150 minutes, and the 6.9 mile Orange (Reavis Barracks) alternative with a cycle time of 130 minutes. Table 2-3 presents additional information regarding layover times. Cycle time includes one minute transit time to and from the Emerson Park pocket track.

In order to improve train spacing/intervals westbound from Emerson Park Station, as well as to provide an improved pocket track vacancy time at Emerson Park, Purple Blue (Kenrick Plaza) and Orange (Reavis Barracks) trains occupy the Emerson Park Station for two minutes. Blue (Butler Hill) alternative and Orange (Butler Hill) trains westbound occupy the Emerson Park Station for three minutes. Further discussion of this situation is provided in the section on Schedule Spacing Modifications.

The cycle time is adjusted to avoid fractional vehicle requirements.

### Vehicle Requirements

The peak number of LRV's required for each extension alternative is calculated by determining the maximum number of train-sets that will be in operation on the alignment at the same time. The maximum number of vehicles required will be during the weekday peak periods when the headway is ten minutes for each of the two services. The respective cycle time for the alternative extension divided by ten minutes yields the number of train-sets which consist of two vehicles each on weekdays. By example, the Blue (Butler Hill) alternative would require 14 train-sets (28 LRV's) during weekday peak-period service.

Table 2-3 presents the fleet requirements of the Lambert/Shiloh operation and each of the alternative alignments. Table 2-4 presents the total system fleet requirements combining Lambert/Shiloh with each of the alternatives. Note that for each alternative a 15% spare allowance was added to the vehicle fleet. This accounts for the potential of some cars to be placed in a "ready reserve" status and cars being out of service for maintenance.

**Table 2-3: Peak Period Fleet Requirements by Operating Segment**

	Run time (min.)	Cycle Time (min.)	Total Layover	Trains	Vehicles
Lambert/Shiloh	148	170	22	17	34
Purple	94	110	16	11	22
Blue - Butler Hill	116	140	24	14	28
Blue - Kenrick	93	110	17	11	22
Orange - Butler Hill	126	150	24	15	30
Orange - Reavis Bks.	113	130	17	13	26

Note: 10-minute headway on each train service

**Table 2-4: Total Fleet Requirements by Alternative**

	Lambert/Shiloh	Required Vehicles/Alternative	System Peak Vehicles	15% Spares	Total Vehicle Fleet
Purple	34	22	56	8	64
Blue - Butler Hill	34	28	62	9	71
Blue - Kenrick	34	22	56	8	64
Orange - Butler Hill	34	30	64	10	74
Orange - Reavis Bks.	34	26	60	9	69

As indicated by Table 2-4, the highest number of vehicles required by any alternative is 74 (Orange to Butler Hill), including spares. This compares with the fleet currently in service (65) and on order (22), which totals 87 cars. This disparity is explained by the decision to lengthen peak headways from 7.5 minutes to 10 minutes for both services.

### Operational Analysis

Based upon the existing schedule of 10-minute peak period headways on the Lambert Airport/Shiloh-Scott service and 10-minute peak period headways on the respective Baseline and System Extension Alternatives, initial observations are as follows. All extension alternatives

permit core headways of 5 minutes eastbound, 7-minute occupancy of the Emerson Park pocket track, an access/egress time of two minutes at the Emerson Park pocket track, and at Forest Park, a clearance time of either five or six minutes between the arrival of an eastbound Lambert Airport/Shiloh-Scott train and a westbound train crossing to the system extension route.

Other observations include:

Purple and Blue (Kenrick Plaza) Alternatives – Westbound core trains are on 6/4 minutes headways from Emerson Park Station, with a 2-minute dwell time at Emerson Park Station. Fleet requirement is 11 trains. Layover at Kenrick is 5 minutes.

Blue (Butler Hill) Alternative – Westbound core trains are on 5-minute headways from Emerson Park Station, with a 3-minute dwell time at Emerson Park Station. Fleet requirement is 14 trains. Layover at Butler Hill is 11 minutes.

Orange (Butler Hill) Alternative – Westbound core trains are on 5-minute headways from Emerson Park Station, with a 3-minute dwell time at Emerson Park Station. Fleet requirement is 15 trains. Layover at Butler Hill is 12 minutes.

Orange (Reavis Barracks) - Westbound core trains are on 5-minute headways from Emerson Park Station, with a 3-minute dwell time at Emerson Park Station. Fleet requirement is 13 trains. Layover at Reavis Barracks is 5 minutes.

The above discussion is summarized in Table 2-5.

Example schedules for each extension alternative, illustrating the AM peak period, are provided in Appendix 2 at the end of this report.

**Table 2-5: Peak Period Cycle Times by Operating Segment**

		<b>Transit Time Eastbound</b>	<b>Layover at Emerson Pk</b>	<b>Transit Time Westbound</b>	<b>Layover at west terminal</b>	<b>Total Cycle Time</b>
Purple		0:47:00	0:11:00	0:47:00	0:05:00	1:50
Blue - Butler Hill		0:58:00	0:12:00	0:58:00	0:12:00	2:20
Blue - Kenrick		0:46:30	0:12:00	0:46:30	0:05:00	1:50
Orange - Butler Hill		1:03:00	0:12:00	1:03:00	0:12:00	2:30
Orange - Reavis Bks.		0:56:00	0:12:00	0:57:00	0:05:00	2:10

Schedule Spacing Modifications

Initial calculations indicated that the Blue and Orange alternatives to Butler Hill could be operated with one fewer train (13 for the Blue and 14 for the Orange) than presented in the previous sections. However, in examining the cycle times of the Blue and Orange alternatives to Butler Hill, using the minimum peak period train requirement, headway problems were encountered, especially westbound between Emerson Park and Forest Park.

Using 13 trains (rather than 14) on the Blue alternative with a 7-minute layover at Emerson Park pocket track (plus 1 minute to and 1 minute from the pocket track), results in westbound trains having a skewed schedule of operating 2 minutes behind a Lambert Airport train, then a headway of 8 minutes before the next westbound train to Lambert Airport. In addition, a layover of only four minutes would be available at Butler Hill.

Similarly, using 14 (rather than 15) trains on the Orange alternative to Butler Hill, with a 7-minute layover at Emerson Park pocket track (plus 1 minute to and 1 minute from the pocket track), results in westbound trains having a skewed schedule of operating 2 minutes behind a Lambert Airport train, then a headway of 8 minutes before the next westbound train to Lambert Airport. In addition, a layover of only five minutes would be available at Butler Hill.

The addition of one train to the Blue and Orange Butler Hill extensions permit 5-minute headways westbound and longer layover times. By using a 3-minute dwell time at Emerson Park Station westbound, the pocket track at Emerson Park is available for the following train. No interference occurs with westbound Lambert Airport trains.

## **3.0 Feeder Bus Operating Plans**

### **3.1 Introduction**

All of the feeder bus plans are based on the expanded bus network that is included in the TSM alternative. That alternative is described in more detail in the report cited above. It includes several new bus routes linking the South County area to the currently planned MetroLink terminus at Shrewsbury – Lansdowne I-44 Station. It also includes a new transit center at South County Center, and extensions to several other bus routes.

The feeder bus plans for each build alternative maintain the same general geographic coverage. However, many routes are re-oriented or re-structured to provide convenient connections with new light rail stations. In addition, some of the service that runs parallel to the rail extension (either existing service or new TSM service) is scaled back, since the rail line will provide higher quality service along the corridor.

### **3.2 Purple and Blue – Kenrick Alternatives**

Both the Purple and Blue-Kenrick alternatives include a single new station on Watson Road near Kenrick Plaza. The feeder bus plan would be the same for both alternatives. The proposed feeder bus plan is shown in the following map. Table 3-1 lists the bus routes in the study area, and shows the changes that would be made from the bus network in the TSM Alternative in order to provide feeder service for these alternatives.

Since the rail extension is relatively short, the feeder bus plan includes enhanced bus service on route 46, extending south from Kenrick Station via Laclede Station and Tesson Ferry Roads to St. Anthony's Medical Center and General American. The enhanced service would include limited stops and signal priority to speed up bus travel times, and the service would be operated with special buses.

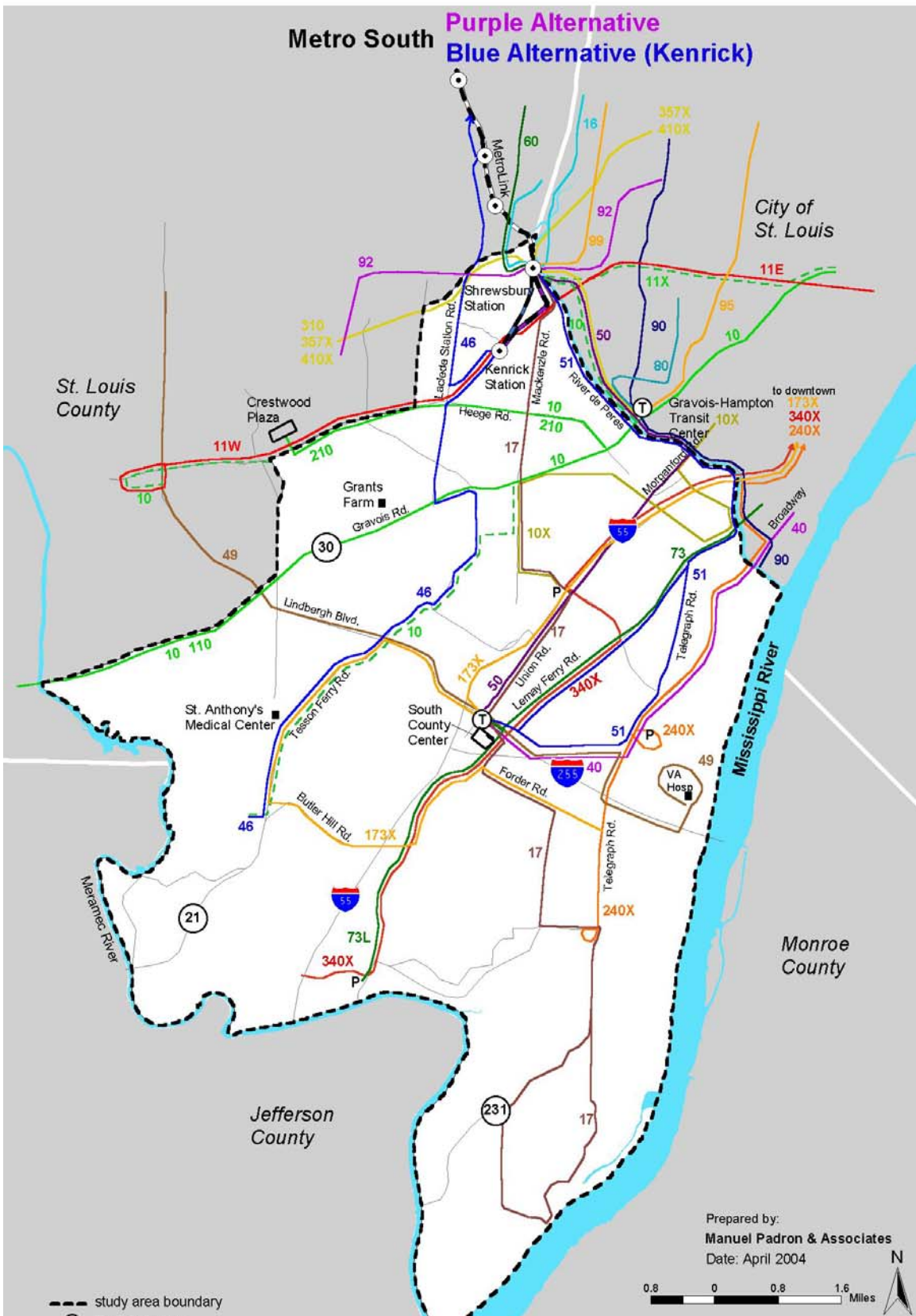
Table 3-2 lists the Kenrick and Shrewsbury-Lansdowne I-44 Stations, along with nearby transit centers, and the feeder routes that connect to each station or transit center. Shrewsbury – Lansdowne I-44 Station would retain its function as a major bus transfer center, with a total of nine bus routes.

**Table 3-1: Feeder Bus System – Purple & Blue (Kenrick) Alternatives**

Route #	Name	Description of Route (Change from TSM Alternative)	Headway (min)		LRT Stations & Transit Centers Served
			Peak	Off-Peak	
10	Gravois	peak turnback at GHTC	30	x	GHTC
10	Gravois - Shrewsbury br.	Gravois, GHTC, Jamieson to Shrewsbury Sta	30	30	GHTC, Shrewsbury
10	Gravois - Watson br.	Gravois, GHTC, Heege, Watson, to Lindbergh	30	x	GHTC
10	Gravois - Gravois br.	Gravois, GHTC, Gravois to Fenton	30	x	GHTC
10	Gravois - Tesson Fy. br.	reverse commute service via Tesson Ferry	180	x	GHTC
110	Fenton shuttle	midday feeder to GHTC	x	60	GHTC
210	Watson Shuttle	midday feeder to GHTC	x	60	GHTC
11	Chippewa	<i>straight via Watson &amp; Chippewa; no deviation to Shrewsbury; add stop at Kenrick Sta.; split into east &amp; west segments</i>	15	20	Kenrick
17	S. County - Shrewsbury via McKenzie	terminal loop of Telegraph, Becker, Christopher; then Telegraph, Forder, SCTC, Union, Reavis, Mackenzie, Watson, River des Peres, Shrewsbury Sta.	30	30	SCTC, Shrewsbury
40	Broadway	Broadway, Kingston, Telegraph, Sappington to SCTC	60	60	SCTC
46S	Tesson Ferry	<i>split route 46 at Kenrick Sta: south portion limited stop service: Watson, Laclede Sta, Tesson Ferry; terminal loop: Hageman, Meramec Bottom, Wells</i>	30	30	Kenrick
46N	Laclede Station	<i>from Maplewood Sta. via Hanley, Laclede Sta, Watson to Kenrick Sta</i>	30	30	Maplewood, Kenrick
49	Lindbergh South	via Lindbergh, SCTC, to VA Hospital	30	60	SCTC
50	S. County - Shrewsbury via Morganford-Jamieson	SCTC, Union, Morganford, Germania, GHTC, Jamieson, Lansdowne, Shrewsbury Sta.	15	30	Shrewsbury, GHTC, SCTC
51	S. County-Shrewsbury via River des Peres/Lemay	Shrewsbury Sta, River des Peres, Carondelet; loop of Telegraph, Barracks View, Lindbergh, SCTC, Lemay Ferry, Carondelet	30	60	Shrewsbury, SCTC
73	Carondelet	via Lemay Ferry to Community College (same as TSM)	30	30	SCTC
173X	Tesson Ferry Express	Tesson Ferry, Lindbergh, SCTC; peak I-55 to downtown	30	60	SCTC
240X	Oakville Express	Telegraph, Kingston, Broadway, Marceau, I-55	30	x	
340X	I-55 Mehlville Express	Lemay Ferry, SCTC, Reavis Bks, I-55 to downtown	30	x	SCTC

GHTC = Gravois-Hampton Transit Center

SCTC = South County Transit Center





**Table 3-2: Feeder Bus Routes by Station – Purple & Blue (Kenrick) Alternatives**

Station/ Transit Ctr.	Route #	Route Name	Terminate or thru?	Notes
<u>Shrewsbury-Lansdowne I-44</u>				
	16	City Limits	term.	both branches
	17	S. County - Shrewsbury via Mackenzie	term.	
	50	S. County - Shrewsbury via Morganford-Jamieson	term.	via Jamieson
	51	River des Peres - Lemay	term.	
	60	Big Bend - (north)	term.	
	92	Lindenwood - Kirkwood - Webster Groves	thru	
	99	Lafayette	term.	
	310	I-44 Fenton Shuttle	thru	via new I-44 interchange
<u>Kenrick</u>				
	11	Chippewa	thru	split east & west
	46S	Tesson Ferry	term.	limited stop service
	46N	Laclede Station	term.	
<u>Gravois/Hampton Transit Center</u>				
	10	Gravois	thru/term.	4 peak branches
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	
	51	River des Peres - Lemay	thru	
	80	Southampton	term.	
	90	Hampton	thru	
	95	Kingshighway	term.	
	110	Fenton shuttle	term.	
	210	Watson shuttle	term.	
<u>South County Transit Center</u>				
	17	S. County - Shrewsbury via Mackenzie	thru	
	40	Broadway	term.	
	49	Lindbergh South	thru	
	50	S. County - Shrewsbury via Morganford-Jamieson	term.	
	51	River des Peres - Lemay	term.	
	73	Lemay Ferry	thru	
	173X	Tesson Ferry Express	thru/term	
	340X	I-55 Mehlville Express	thru	

### **3.3. Blue Alternative (Butler Hill terminus)**

The Blue Alternative leaves the Shrewsbury-Lansdowne I-44 Station via the BNSF railway, and follows that south to Lindbergh Boulevard. It follows Lindbergh Boulevard to South County Center, and then enters the Interstate 55 corridor. It continues south along Interstate 55 to a terminal station at Butler Hill Road. [A one-station version of the Blue alignment, terminating at Kenrick Plaza (Watson Road) has the same feeder bus plan as the Purple Alternative, described in the previous section.]

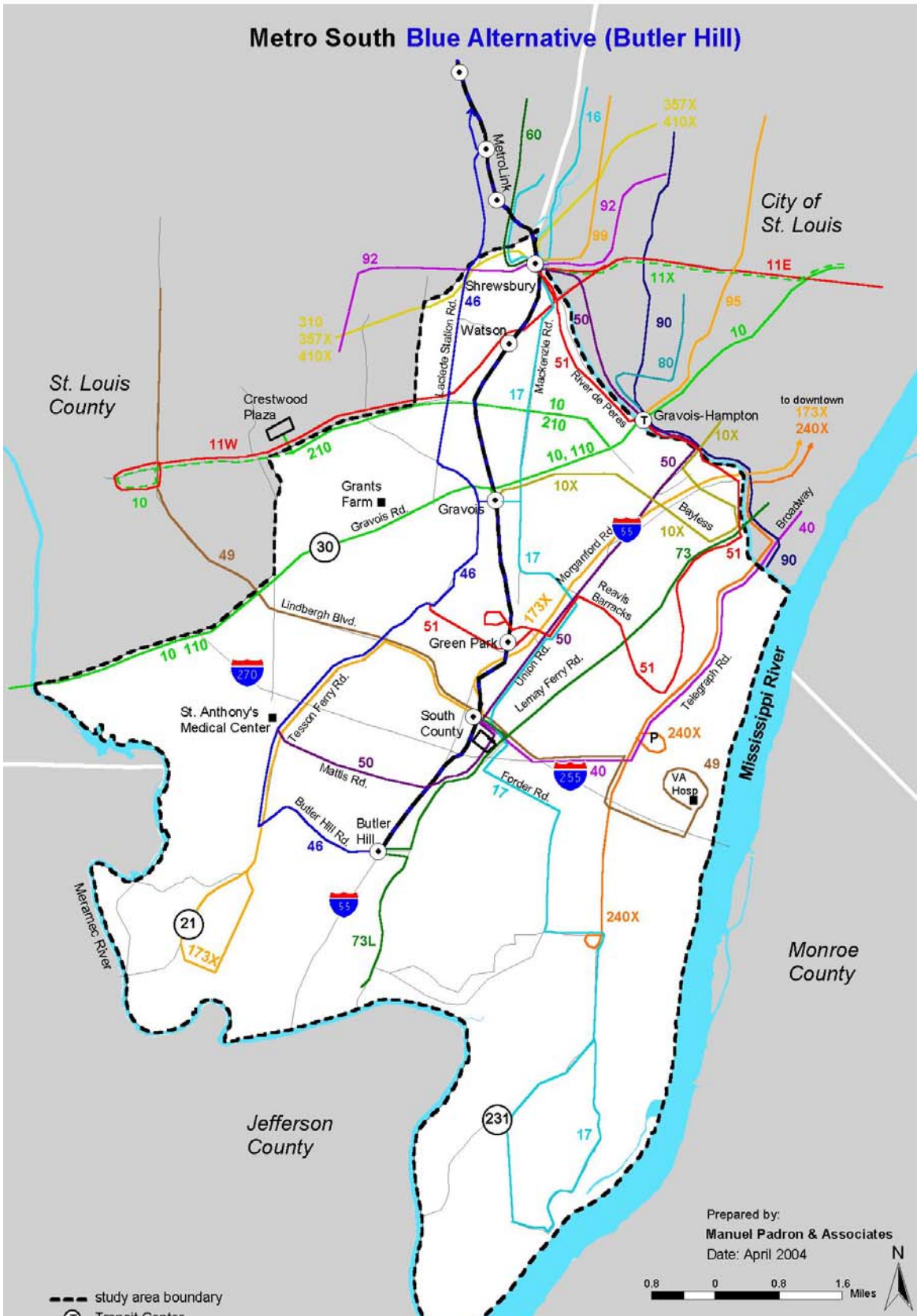
The proposed feeder bus plan for the Blue Alternative is shown in the following map. Table 3-3 lists all of the bus routes in the study area, and indicates the changes that were made from the bus network in the Purple Alternative in order to provide feeder service for the Blue Alternative.

Table 3-4 lists each of the five stations along the Blue Alternative, and the feeder routes that connect to that station. Shrewsbury-Lansdowne I-44 Station would retain its function as a major bus transfer center, with a total of eight bus routes. The Gravois Station and the South County Station would also be major transit centers, with five and six feeder bus routes, respectively. The other three stations would have one or two feeder routes each.

**Table 3-3: Feeder Bus System – Blue Alternative to Butler Hill**

Route #	Name	Description of Change (from Purple Altern.)	Headway (min)		LRT Stations & Transit Centers Served
			Peak	Off-Peak	
10	Gravois (turnback)	extend from Gravois- Hampton T.C. to Gravois Sta; add offpeak	15	30	GHTC, Gravois
10	Gravois - Shrewsbury br.	delete branch	x	x	
10	Gravois - Watson branch	no change (no connection to MetroLink)	30	x	GHTC
10	Gravois - Gravois branch	deviate via Gravois Station;	20	x	GHTC, Gravois
10	Gravois - Tesson Fy. br.	delete branch (served by #46)	x	x	
10X	South Grand Express	terminate at Gravois Station; add reverse peak service from GHTC & Germania to connect Bayless to Gravois Sta.	20	x	Gravois
110	Fenton Shuttle	deviate via Gravois Station	x	60	GHTC, Gravois
210	Watson Shuttle	no change (no connection to MetroLink)	x	60	GHTC
11	Chippewa	same; serves Kenrick Sta. via Watson	15	20	Kenrick
17	S. County - Shrewsbury via McKenzie	add stop at S. County Sta; deviate via Gravois Sta.	30	60	S. County, Gravois, Shrewsbury
40	Broadway	connect to South County Station	60	60	S. County
46	Laclede Station	delete Kenrick Sta. deviation; deviate via Gravois Sta.; reroute south end via Butler Hill to Butler Hill Sta; revise offpeak headway	30	60	Maplewood, Gravois, Butler Hill
49	Lindbergh	add stop at S. County Sta.	30	60	S. County
50	Morganford - Jamieson	St. Anthony's Hosp, Mattis, Lemay Ferry, S. County Sta, Union, Morganford, Germania, GHTC, Jamieson, Lansdowne, Shrewsbury Sta; revise headways.	30	60	S. County, GHTC, Shrewsbury
51	River des Peres-Lemay-Green Park	same from Shrewsbury Sta. to Telegraph; then Reavis Barracks, Union, Green Park to station, continue to Tesson Ferry; branch to Green Pk. industrial area	30	60	Shrewsbury, GHTC, Green Park
73	Lemay Ferry	deviate via South County Station	30	30	S. County, Butler Hill
173X	Tesson Ferry Express	outer terminal in former #46 loop; then via Tesson Ferry, Lindbergh, S. County Sta; peak I-55 to downtown	30	60	S. County, downtown (peak)
240X	Oakville Express	same	30	x	downtown
340X	I-55 Mehlville Express	delete route	x	x	

GHTC = Gravois-Hampton Transit Center



**Table 3-4: Feeder Bus Routes by Station – Blue Alternative to Butler Hill**

Station	Route #	Route Name	Terminate or thru?	Notes
<u>Shrewsbury-Lansdowne I-44</u>				
	16	City Limits	term.	both branches
	17	S. County - Shrewsbury via Mackenzie	term.	
	50	Morganford - Jamieson	term.	
	51	River des Peres - Lemay - Green Park	term.	
	60	Big Bend - (north)	term.	
	92	Lindenwood - Kirkwood - Webster Groves	thru	
	99	Lafayette	term.	
	310	I-44 Fenton Shuttle	term.	
<u>Kenrick</u>				
	11	Chippewa	thru	
<u>Gravois</u>				
	10	Gravois (Gravois branch)	both	offpeak term.
	17	S. County - Shrewsbury via Mackenzie	thru	
	110	Fenton shuttle	term.	
	10X	South Grand Express	term.	
	46	Laclede Station	thru	
<u>Green Park</u>				
	51	River des Peres - Lemay - Green Park	thru/term.	spur to industrial area
<u>South County</u>				
	17	S. County - Shrewsbury via Mackenzie	thru	
	40	Broadway	term.	
	49	Lindbergh South	thru	
	50	Morganford - Jamieson	term.	
	73	Lemay Ferry	thru	
	173X	Tesson Ferry express	thru/term	
<u>Butler Hill</u>				
	46	Laclede Station	term.	
	73	Lemay Ferry	thru	
<i>Station design should allow for possible future bus routes from Jefferson County.</i>				

### **3.4. Orange Alternative (Butler Hill terminus)**

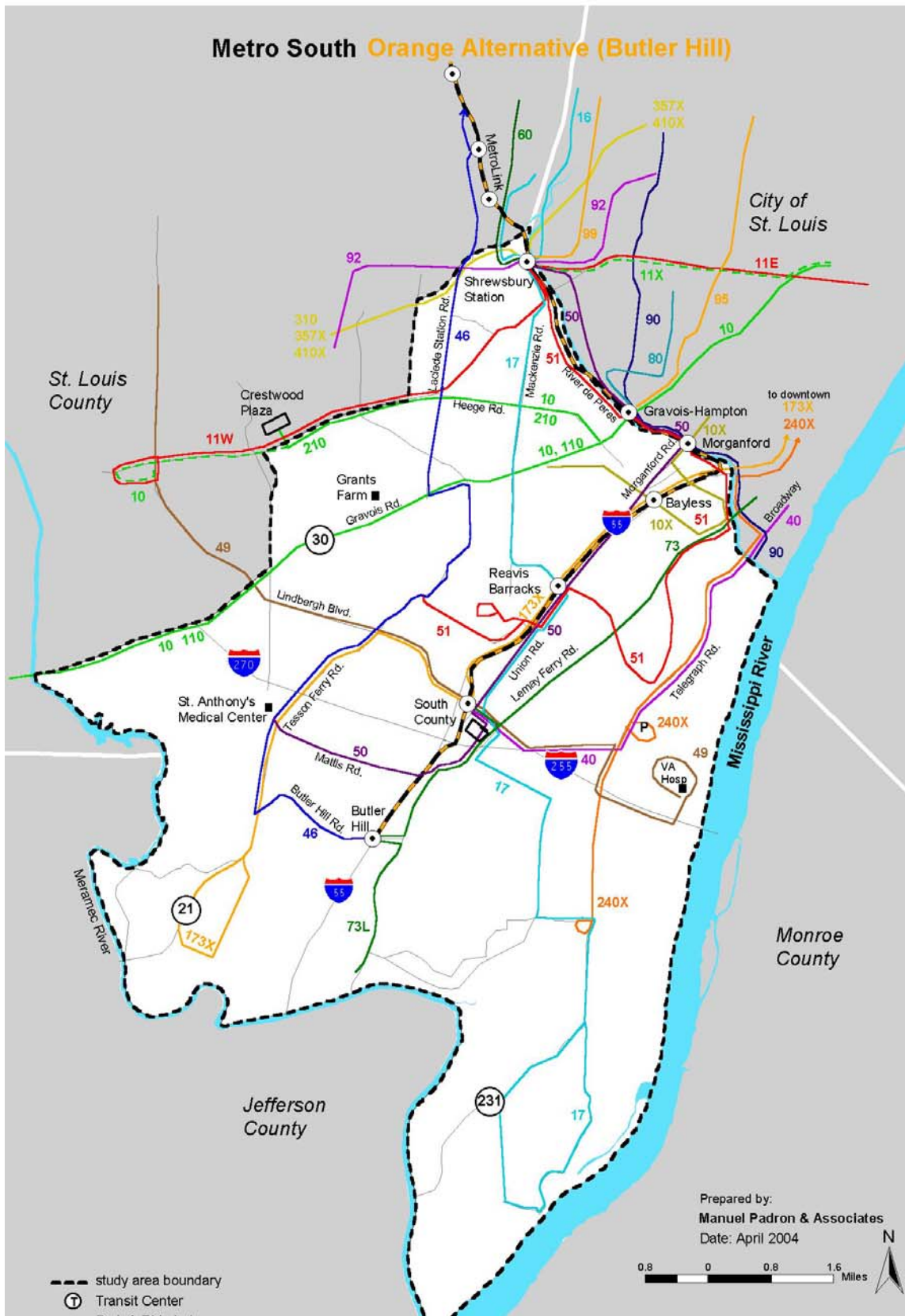
The Orange Alternative is the eastern most alignment. It leaves Shrewsbury-Lansdowne I-44 Station and proceeds southeast along River Des Peres Boulevard to Interstate 55, where it turns southwest and runs as far as Butler Hill Road. Near the South County Center, the alignment deviates from the interstate to access the mall area. A shortened version of this alignment is discussed in the next section as the Orange – Reavis Barracks Alternative.

The proposed feeder bus plan for the Orange Alternative to Butler Hill is shown in the following map. Table 3-5 lists all of the bus routes in the study area, and indicates the changes that were made from the bus network in the Blue Alternative to Butler Hill, in order to provide feeder service for the Orange Alternative to Butler Hill.

Table 3-6 lists each of the six stations along the Orange Alternative to Butler Hill, and the feeder routes that connect to that station. Shrewsbury-Lansdowne I-44 Station would retain its function as a major bus transfer center, with a total of eight bus routes. The Gravois/Hampton Station would include all of the routes that currently use the existing transit center at that location. The South County Station would also be a major transit center with six feeder bus routes. The other four stations would have from one to four feeder routes each.

**Table 3-5: Feeder Bus System – Orange Alternative to Butler Hill**

Route #	Name	Description of Change (from Blue Altern.)	Headway (min)		LRT Stations & Transit Centers Served
			Peak	Off-Peak	
10	Gravois (turnback)	move terminal back to Gravois/Hampton Station	15	30	Gravois/Hampton
10	Gravois - Watson br.	connect to Gravois/Hampton Sta.	30	x	Gravois/Hampton
10	Gravois - Gravois br.	remove deviation at Gravois Sta.(B3); connect to Gravois/Hampton Sta.	30	x	Gravois/Hampton
10X	South Grand Express	shorten route; outer terminal at Gravois/Mackenzie	20	x	Bayless
110	Fenton Shuttle	connect to Gravois/Hampton Sta.	x	60	Gravois/Hampton
210	Watson Shuttle	connect to Gravois/Hampton Sta.	x	60	Gravois/Hampton
11	Chippewa	deviate via Shrewsbury Station (as in TSM)	15	20	Shrewsbury
17	S. County - Shrewsbury via McKenzie	no Gravois Sta. deviation; add stop at Reavis Barracks Sta.	30	60	S. County, Reavis Barracks, Shrewsbury
40	Broadway	same	60	60	S. County
46	Laclede Station	no deviation to Gravois Sta. (B3)	30	60	Maplewood, Butler Hill
49	Lindbergh	same	30	60	S. County
50	Morganford - Jamieson	add stops at Reavis Barracks, Morganford, Gravois/Hampton Sta's	30	60	S. County, Morganford, Gravois/Hampton, Shrewsbury
51	River des Peres-Lemay-Green Park	make stop at Reavis Barracks vs. Green Park Sta.; deviate to Morganford Sta, then via Germania to Gravois-Hampton Sta.	30	60	Reavis Barracks, Morganford, Gravois-Hampton, Shrewsbury
73	Lemay Ferry	same	30	30	S. County, Butler Hill
80	Southampton	shift terminal to Gravois/Hampton Station	30	30	Gravois/Hampton
90	Hampton	shift stop to Gravois/Hampton Station; add stop at Morganford Sta.	15	30	Gravois/Hampton, Morganford
95	Kingshighway	shift terminal to Gravois/Hampton Station	10-15	15	Gravois/Hampton
173X	Tesson Ferry Express	same	30	60	S. County; downtown (peak)
240X	Oakville Express	same	30	x	downtown





**Table 3-6: Feeder Bus Routes by Station – Orange Alternative to Butler Hill**

<u>Station</u>	<u>Route #</u>	<u>Route Name</u>	<u>Terminate or thru?</u>	<u>Notes</u>
<u>Shrewsbury-Lansdowne I-44</u>				
	11	Chippewa	thru	
	16	City Limits	term.	both branches
	17	S. County - Shrewsbury via Mackenzie	term.	
	50	Morganford - Jamieson	term.	
	51	River des Peres - Lemay - Green Park	term.	
	60	Big Bend - (north)	term.	
	92	Lindenwood - Kirkwood - Webster Groves	thru	
	99	Lafayette	term.	
	310	I-44 Fenton Shuttle	thru	
<u>Gravois/Hampton</u>				
	10	Gravois	both	peak thru, offpeak term.
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	
	51	River des Peres - Lemay - Green Park	thru	
	80	Southampton	term.	
	90	Hampton	thru	
	95	Kingshighway	term.	
	110	Fenton shuttle	term.	
	210	Watson shuttle	term.	
<u>Morganford</u>				
	10X	South Grand Express	thru	
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	
	51	River des Peres - Lemay - Green Park	thru	
	90	Hampton	thru	
<u>Bayless</u>				
	10X	South Grand Express	thru	
<u>Reavis Barracks</u>				
	17	Reavis Baracks - McKenzie	thru	
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	
	51	River des Peres - Lemay - Green Park	thru	
<u>South County</u>				
	17	S. County - Shrewsbury via Mackenzie	thru	
	40	Broadway	term.	
	49	Lindbergh South	thru	
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	SW to Mattis
	73	Lemay Ferry	thru	
	173X	Tesson Ferry express	thru/term	peak thru, offpeak term.
<u>Butler Hill</u>				
	46	Laclede Station	term.	
	73	Lemay Ferry	thru	
<i>Station design should allow for possible future bus routes from Jefferson County.</i>				

### 3.5. Orange – Reavis Barracks Alternative

This alternative is a shortened version of the full Orange alignment, terminating at Reavis Barracks Station. The proposed feeder bus plan is shown in the following map. Table 3-7 lists all of the bus routes in the study area, and indicates the changes that were made from the bus network in the Orange – Butler Hill Alternative in order to provide feeder service the Orange – Reavis Barracks Alternative.

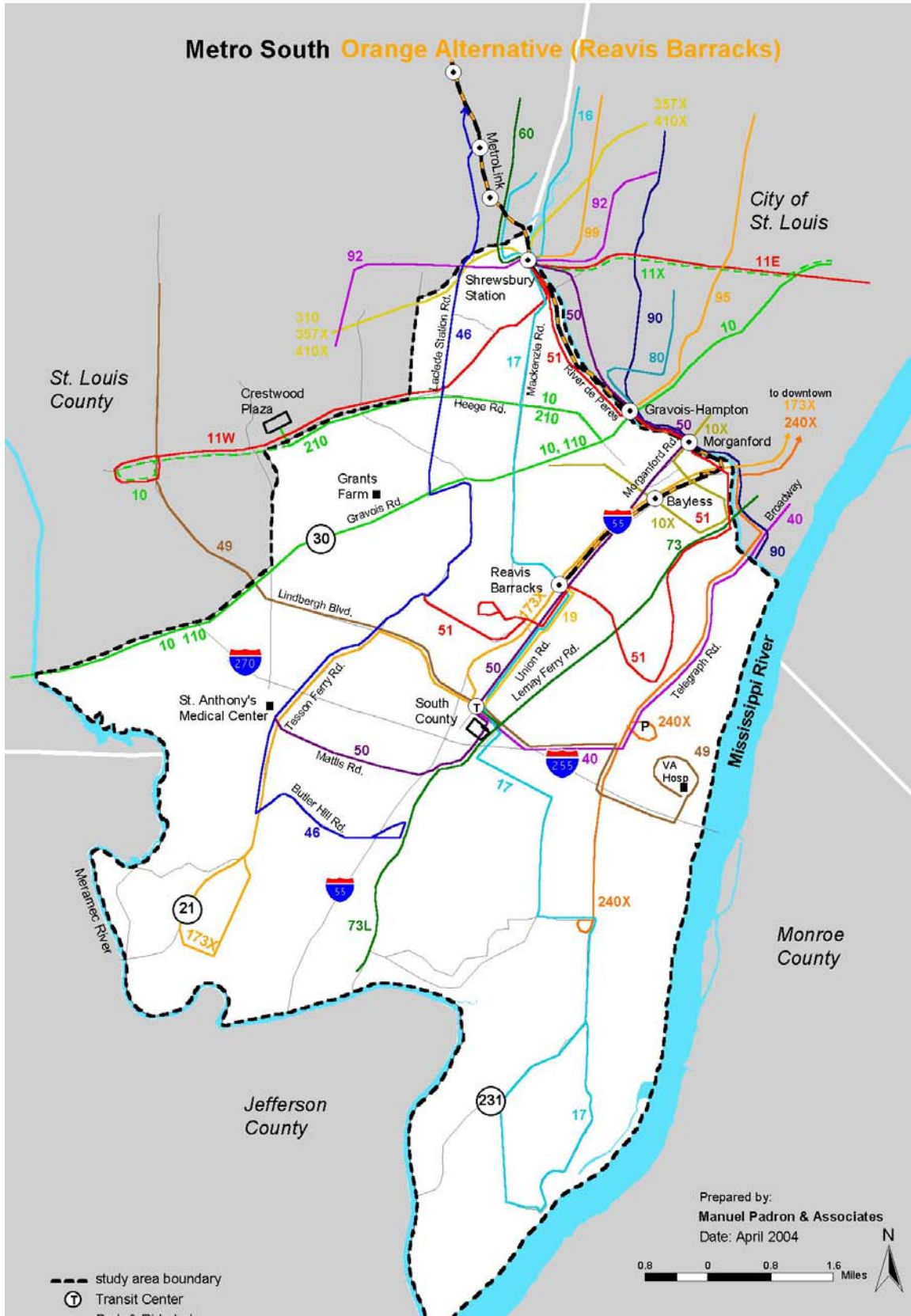
Table 3-8 lists each of the five stations along the Orange – Reavis Barracks Alternative, and the feeder routes that connect to that station. Shrewsbury Station would retain its function as a major bus transfer center, with a total of nine bus routes. The Gravois/Hampton Station and the South County Station would also be major transit centers, with eight and six feeder bus routes, respectively. The other three stations would have from one to five feeder routes each.

**Table 3-7: Feeder Bus System – Orange – Reavis Barracks Alternative**

Route #	Name	Description of Change (from Orange-BH Altern.)	Headway (min)		LRT Stations & Transit Centers Served
			Peak	Off-Peak	
10	Gravois (turnback)	same	15	30	Gravois/Hampton
10	Gravois - Watson br.	same	30	x	Gravois/Hampton
10	Gravois - Gravois br.	same	30	x	Gravois/Hampton
10X	South Grand Express	same	20	x	Bayless
110	Fenton Shuttle	same	x	60	Gravois/Hampton
210	Watson Shuttle	same	x	60	Gravois/Hampton
11	Chippewa	same	15	20	Shrewsbury
17	S. County - Shrewsbury via McKenzie	SCTC vs. S. County Station	30*	60*	SCTC, Reavis Barracks, Shrewsbury
19	S. County - Reavis Barracks shuttle	NEW: Reavis Barracks Sta. to S. County T.C. via Union; supplement #17 & #50 to provide combined headway matching MetroLink	15*	15*	SCTC, Reavis Barracks
40	Broadway	SCTC vs. S. County Station	60	60	SCTC
46	Laclede Station	terminal loop at Lemay Ferry Rd. (no Butler Hill Sta.)	30	60	Maplewood
49	Lindbergh	SCTC vs. S. County Station	30	60	SCTC
50	Morganford - Jamieson	SCTC vs. S. County Station; deviate via Reavis Barracks Sta.	30*	60*	SCTC, Reavis Barracks, Morganford, Gravois/Hampton, Shrewsbury
51	River des Peres-Lemay-Green Park	same	30	60	Reavis Barracks, Morganford, Gravois/Hampton, Shrewsbury
73	Lemay Ferry	no deviation to Butler Hill Sta; SCTC vs. S. County Sta.	30	30	SCTC
80	Southampton	same	30	30	Gravois/Hampton
90	Hampton	same	15	30	Gravois/Hampton
95	Kingshighway	same	10-15	15	Gravois/Hampton
173X	Tesson Ferry Express	skip SCTC; via I-55 to Reavis Bks Sta; peak continue to downtown, offpeak end at Reavis Bks	30	60	Reavis Barracks; downtown (peak)
240X	Oakville Express	same	30	x	downtown

\* combined headways of 7.5 & 10 between Reavis Barracks Sta. & SCTC

SCTC = South County Transit Center



**Table 3-8: Feeder Bus Routes by Station – Orange –Reavis Barracks Alternative**

Station	Route #	Route Name	Terminate or thru?	Notes
<u>Shrewsbury-Lansdowne I-44</u>				
	11	Chippewa	thru	
	16	City Limits	term.	both branches
	17	S. County - Shrewsbury via Mackenzie	term.	
	50	Morganford - Jamieson	term.	
	51	River des Peres - Lemay - Green Park	term.	
	60	Big Bend - (north)	term.	
	92	Lindenwood - Kirkwood - Webster Groves	thru	
	99	Lafayette	term.	
	310	I-44 Fenton Shuttle	thru	
<u>Gravois/Hampton</u>				
	10	Gravois	both	peak thru, offpeak term.
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	
	51	River des Peres - Lemay - Green Park	thru	
	80	Southampton	term.	
	90	Hampton	thru	
	95	Kingshighway	term.	
	110	Fenton shuttle	term.	
	210	Watson shuttle	term.	
<u>Morganford</u>				
	10X	South Grand Express	thru	
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	
	51	River des Peres - Lemay - Green Park	thru	
	90	Hampton	thru	
<u>Bayless</u>				
	10X	South Grand Express	thru	
<u>Reavis Barracks</u>				
	17	Reavis Baracks - McKenzie	thru	
	19	S. County - Reavis Barracks shuttle	term.	
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	
	51	River des Peres - Lemay - Green Park	thru	
	173X	Tesson Ferry express	thru/term	peak thru, offpeak term.
<u>South County Transit Center</u>				
	17	S. County - Shrewsbury via Mackenzie	thru	
	19	S. County - Reavis Barracks shuttle	term.	
	40	Broadway	term.	
	49	Lindbergh South	thru	
	50	S. County - Shrewsbury via Morganford-Jamieson	thru	
	73	Lemay Ferry	thru	

## 4.0 Operating and Maintenance Costs

This chapter describes the process used to estimate operating and maintenance (O&M) costs for the various study alternatives. The first section describes the cost model itself, the second section describes the operating statistics used as input to the model, and the final section presents the cost estimates for the alternatives.

### 4.1. Operating and Maintenance Cost Methodology

Operating and maintenance (O&M) costs are estimated with a spreadsheet model created for Metro's operations. The O&M cost model is structured in accordance with Federal Transit Administration guidelines for Alternatives Analysis and based on Metro's FY 2004 operating budget and projected service levels. Additionally, the cost model is disaggregate and resource build-up in format, such that each labor cost and non-labor expense are determined by the baseline (FY 2004) quantity of service supplied (e.g., number of peak buses required) or other bus or rail system characteristic (e.g., number of maintenance facilities) and Metro's current productivity and consumption rates. The model's equations are mutually exclusive and cover all operating costs for bus, light rail, and paratransit.

The cost model is developed with Microsoft Excel and includes three worksheets:

- Input Statistics,
- Line Item Detail, and
- Summary by Cost Center and Object Class.

#### Input Statistics

Thirteen transit system characteristics are used as inputs to Metro's O&M cost:

<i>Annual Revenue Bus-Miles</i> – Total directly-operated bus-miles in revenue service, including special events but excluding deadhead mileage
<i>Annual Revenue Bus-Hours</i> – Total directly-operated bus-hours in revenue service, including layovers but excluding report and deadhead time
<i>Peak Buses</i> – The maximum number of directly-operated buses required to operate simultaneously in scheduled service
<i>Bus Maintenance Facilities</i> – The number of service and inspection garages for Metro's bus fleet
<i>Annual Revenue Car-Miles</i> – Total miles operated by all rail cars in scheduled service, excluding deadhead mileage
<i>Annual Revenue Train-Hours</i> – Total hours operated by all trains

revenue service, excluding report and deadhead time
<i>Peak Cars</i> – The maximum number of light rail vehicles operating simultaneously in scheduled service
<i>Light Rail Maintenance Facilities</i> – The number of light rail maintenance and storage yards
<i>Stations</i> – The number of light rail passenger stations in the system
<i>Directional Route Miles</i> – The miles of revenue track, excluding yard and tail track (e.g., one mile of double track equals two directional route-miles)
<i>Annual Revenue Paratransit-Miles</i> – Total vehicle-miles in revenue service
<i>Annual Revenue Paratransit-Hours</i> – Total vehicle-hours in revenue service
<i>Paratransit Maintenance Facilities</i> – The number of service and inspection garages for Metro’s paratransit fleet

Every modeled expense is linked directly or indirectly to one or more of these inputs, for which Metro staff provided FY 2004 baseline or calibration values. For that reason, they are labeled as “driving variables” or “drivers” in the model. Modeling future alternatives requires a similar set of input values for each potential operating scenario.

### Line Item Detail

The model’s Line Item Detail worksheet duplicates Metro’s FY 2004 operating budget at the summary level for each of the agency’s cost centers except for Arch, Parking Facility, Riverboats and Airport. Every line item includes its three-digit National Transit Database object class.

The O&M cost model acknowledges the reality that some costs are fixed. As an extreme example, even if Metro were to triple the amount of its service, there would still be only one CEO. Thus, the line items modeled as fixed represent expenses that realistically would not change, whether service was substantially increased or severely curtailed.

Each line item is assigned a driving variable, which is the factor or factors assumed to be most influential in changing the item’s annual cost. For example, annual revenue bus-hours are assumed to be primarily responsible for the amount of bus operators’ wages; annual revenue car-miles are assumed to be most influential in determining the cost of LRV maintenance materials and supplies.

Because the model implicitly assumes that current rates of consumption and labor productivity will continue into the future, expenses are calculated as a function of Metro’s base year (2004) cost, and the base and future values of the driving variable(s). Accordingly, cost equations used by the model generally are of the form:

<b>Estimated Annual Cost</b>	=	<b>Actual Base Year Cost</b>	/	<b>Driving Variable Value for Base Year</b>	*	<b>Driving Variable Value for Future Year</b>
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The model includes a table that displays the cost for each model run by cost center and expense object class. Object classifications are:

501	Wages and Salaries
502	Benefits
503	Services
504	Materials & Supplies
505	Utilities
506	Casualty/Liability
507	Taxes
509	Other Expenses (Miscellaneous)
510	Transfers and Capitalized Expenses
512	Other Expenses (Leases/Rentals)

#### 4.2. Operating Statistics

The operating statistics used as inputs for the cost model have been estimated for each study alternative based on the proposed operating plans for the year 2025. Rail operating statistics were described in Chapter 2, and are summarized in Table 4-1.

Operating statistics for bus service were estimated using data derived from the ridership model. The ridership model produces estimates of running time for each bus route. These estimates were used to estimate cycle times, including layover. The cycle times and the proposed headways from the operating plans were used to estimate peak and off-peak bus requirements. These were expanded to weekday and then to annual statistics, using factors derived from current operating statistics. The resulting statistics for each alternative are shown in the bus section of Table 4-1. Paratransit service is assumed to vary in direct proportion to bus service.

#### 4.3. Operating and Maintenance Cost Results

Table 4-1 also shows the estimated annual O&M costs for each alternative. The costs are allocated between rail and bus, with a proportional share of G&A costs allocated to each mode. All costs are in FY2004 dollars, while the operating statistics represent 2025 levels of service.

The TSM Alternative has an incremental cost of \$4.5 million annually compared to the No-Build Alternative; all of the extra cost is for improved bus service.

The five build alternatives have incremental rail costs in the range of \$4.3 to \$7.9 million.

- The Purple Alternative has an incremental cost of \$4.3 million; rail costs are slightly higher, but are offset by lower bus costs. The Blue-Kenrick Alternative has the same costs.
- The Blue Alternative (Butler Hill) has an incremental cost of \$7.1 million.
- The Orange Alternative (Butler Hill) has an incremental cost of \$7.9 million. The Orange - Reavis Barracks Alternative is slightly less at \$5.6 million.

**Table 4-1: Operating & Maintenance Cost Summary**

	No-Build	Baseline	Purple Kenrick	Blue Butler Hill	Blue Kenrick	Orange Butler Hill	Orange Reavis Bks.
<b>Rail</b>							
Stations	38	38	39	43	39	44	42
System Miles	50.9	50.9	52.36	59.7	52.31	61.9	57.8
Track Miles	101.8	101.8	104.7	119.3	104.6	123.8	115.7
Peak Cars	56	56	56	62	56	64	60
Annual Car-Miles	6,508,946	6,508,946	6,685,181	7,542,858	6,679,307	7,801,336	7,319,627
Annual Train-Hours	158,118	158,118	158,118	175,060	158,118	180,707	169,413
O&M Facilities	2	2	2	2	2	2	2
Annual O&M Cost (millions \$2004)	\$48.1	\$47.9	\$48.6	\$53.3	\$48.6	\$54.7	\$52.0
<b>Bus</b>							
Peak Buses	367	373	374	367	374	365	366
Annual Bus-Miles	17,358,000	18,368,492	18,181,794	17,922,399	18,181,794	17,820,106	17,835,214
Annual Bus-Hours	1,101,200	1,152,257	1,143,338	1,126,882	1,143,338	1,120,885	1,125,037
O&M Facilities	4	4	4	4	4	4	4
<b>Paratransit</b>							
Annual Vehicle-Miles	5,818,200	6,156,905	6,094,326	6,007,380	6,094,326	5,973,093	5,978,157
Annual Vehicle-Hours	326,800	341,952	339,305	334,422	339,305	332,642	333,874
Peak Vehicles	101	103	103	101	103	100	101
Annual O&M Cost (Bus & Paratransit)	\$137.6	\$142.1	\$141.3	\$139.4	\$141.3	\$138.8	\$139.3
<b>Total Cost</b>							
(Millions of \$2004)	\$185.6	\$190.1	\$189.9	\$192.7	\$189.9	\$193.5	\$191.3
<b>Incremental Cost (vs. No-Build)</b>							
	Base	\$4.5	\$4.3	\$7.1	\$4.3	\$7.9	\$5.6



# Appendices

1. Rail Run Times for Alternative Extensions
2. AM Peak Schedules for Alternatives

## Appendix 1. Rail Run Times for Alternative Extensions

Purple Alternative						
Southbound			Shrewsbury	Northbound		
MpH	Time	Distance Feet		Distance Feet	Time	MpH
29.21	0:03:00	7,722	<b>KENRICK</b>	7,632	0:02:50	30.53
29.21	0:03:00	7,722		<b>Total</b>	7,632	0:02:50

Distance, running time between stations

Blue Alternative to Butler Hill						
Southbound			Shrewsbury	Northbound		
MpH	Time	Distance Feet		Distance Feet	Time	MpH
32.81	0:02:35	7,476	<b>Kenrick</b>	7,386	0:02:27	34.20
	0:00:20				0:00:20	
46.27	0:02:58	12,049	<b>Gravois/Reavis</b>	12,049	0:03:01	45.39
	0:00:20				0:00:20	
44.26	0:02:39	10,350	<b>Green Park</b>	10,350	0:02:39	44.36
	0:00:20				0:00:20	
36.51	0:01:37	5,199	<b>Lindbergh</b>	5,199	0:01:37	36.47
	0:00:20				0:00:20	
36.93	0:03:27	11,191	<b>Butler Hill</b>	11,191	0:03:17	38.73
36.01	0:14:36	46,265	<b>Total</b>	46,175	0:14:21	36.54

Distance, running time between stations  
Station Dwell

Blue Alternative to Kenrick						
Southbound			Shrewsbury	Northbound		
MpH	Time	Distance Feet		Distance Feet	Time	MpH
32.81	0:02:35	7,476	<b>KENRICK</b>	7,386	0:02:27	34.20
32.81	0:02:35	7,476		<b>Total</b>	7,386	0:02:27

Distance, running time between stations

**Orange Alternative to Butler Hill**

Southbound			Shrewsbury	Northbound		
MpH	Time	Distance Feet		Distance Feet	Time	MpH
38.80	0:04:01	13,740	<b>Gravois</b>	13,650	0:04:02	38.53
	0:00:20					0:00:20
17.82	0:02:27	3,850	<b>Morganford</b>	3,850	0:01:39	26.41
	0:00:20					0:00:20
19.36	0:05:47	9,856	<b>Bayless</b>	9,856	0:03:16	34.20
	0:00:20					0:00:20
41.46	0:02:31	9,170	<b>Reavis Barracks</b>	9,170	0:02:34	40.68
	0:00:20					0:00:20
43.50	0:02:44	10,484	<b>South County</b>	10,484	0:02:43	43.75
	0:00:20					0:00:20
37.66	0:03:20	11,042	<b>Butler Hill</b>	11,042	0:03:15	38.57
29.34	0:22:31	58,142	<b>Total</b>	58,052	0:19:10	34.43

Distance, running time between stations  
Station Dwell

**Orange Alternative to Reavis Barracks**

Southbound			Shrewsbury	Northbound		
MpH	Time	Distance Feet		Distance Feet	Time	MpH
38.80	0:04:01	13,740	<b>Gravois</b>	13,650	0:04:02	38.53
	0:00:20					0:00:20
17.82	0:02:27	3,850	<b>Morganford</b>	3,850	0:01:39	26.41
	0:00:20					0:00:20
19.36	0:05:47	9,856	<b>Bayless</b>	9,856	0:03:16	34.22
	0:00:20					0:00:20
41.46	0:02:31	9,170	<b>Reavis Barracks</b>	9,170	0:02:33	40.80
26.37	0:15:47	36,616	<b>Total</b>	36,526	0:12:31	33.18

Distance, running time between stations  
Station Dwell

Appendix 2. AM Peak Schedules for Alternatives

**PURPLE ALTERNATIVE EXTENSION WITH EXISTING LAMBERT SCHEDULE (10-minute headway)**

Eastbound							Westbound					
Purple Run Number	Lambert Main Terminal	PURPLE Kenrick	Shrewsbury	Forest Park	Emerson Park	Emerson Pocket	Emerson Pocket	Emerson Park	Forest Park	Shrewsbury	PURPLE Kenrick	Lambert Main Terminal
	7:08 AM			7:27 AM	7:51 AM			8:03 AM	8:27 AM			8:47 AM
1		7:09 AM	7:12 AM	7:32 AM	7:56 AM	7:57 AM	8:04 AM	8:07 AM	8:31 AM	8:51 AM	8:54 AM	
	7:18 AM			7:37 AM	8:01 AM			8:13 AM	8:37 AM			8:57 AM
2		7:19 AM	7:22 AM	7:42 AM	8:06 AM	8:07 AM	8:14 AM	8:17 AM	8:41 AM	9:01 AM	9:04 AM	
	7:28 AM			7:47 AM	8:11 AM			8:23 AM	8:47 AM			9:07 AM
3		7:29 AM	7:32 AM	7:52 AM	8:16 AM	8:17 AM	8:24 AM	8:27 AM	8:51 AM	9:11 AM	9:14 AM	
	7:38 AM			7:57 AM	8:21 AM			8:33 AM	8:57 AM			9:17 AM
4		7:39 AM	7:42 AM	8:02 AM	8:26 AM	8:27 AM	8:34 AM	8:37 AM	9:01 AM	9:21 AM	9:24 AM	
	7:48 AM			8:07 AM	8:31 AM			8:43 AM	9:07 AM			9:27 AM
5		7:49 AM	7:52 AM	8:12 AM	8:36 AM	8:37 AM	8:44 AM	8:47 AM	9:11 AM	9:31 AM	9:34 AM	
	7:58 AM			8:17 AM	8:41 AM			8:53 AM	9:17 AM			9:37 AM
6		7:59 AM	8:02 AM	8:22 AM	8:46 AM	8:47 AM	8:54 AM	8:57 AM	9:21 AM	9:41 AM	9:44 AM	
	8:08 AM			8:27 AM	8:51 AM			9:03 AM	9:27 AM			9:47 AM
7		8:09 AM	8:12 AM	8:32 AM	8:56 AM	8:57 AM	9:04 AM	9:07 AM	9:31 AM	9:51 AM	9:54 AM	
	8:18 AM			8:37 AM	9:01 AM			9:13 AM	9:37 AM			9:57 AM
8		8:19 AM	8:22 AM	8:42 AM	9:06 AM	9:07 AM	9:14 AM	9:17 AM	9:41 AM	10:01 AM	10:04 AM	
	8:28 AM			8:47 AM	9:11 AM			9:23 AM	9:47 AM			10:07 AM
9		8:29 AM	8:32 AM	8:52 AM	9:16 AM	9:17 AM	9:24 AM	9:27 AM	9:51 AM	10:11 AM	10:14 AM	
	8:38 AM			8:57 AM	9:21 AM			9:33 AM	9:57 AM			10:17 AM
10		8:39 AM	8:42 AM	9:02 AM	9:26 AM	9:27 AM	9:34 AM	9:37 AM	10:01 AM	10:21 AM	10:24 AM	
	8:48 AM			9:07 AM	9:31 AM			9:43 AM	10:07 AM			10:27 AM
11		8:49 AM	8:52 AM	9:12 AM	9:36 AM	9:37 AM	9:44 AM	9:47 AM	10:11 AM	10:31 AM	10:34 AM	
	8:58 AM			9:17 AM	9:41 AM			9:53 AM	10:17 AM			10:37 AM
1		8:59 AM	9:02 AM	9:22 AM	9:46 AM	9:47 AM	9:54 AM	9:57 AM	10:21 AM	10:41 AM	10:44 AM	
	9:08 AM			9:27 AM	9:51 AM			10:03 AM	10:27 AM			10:47 AM
2		9:09 AM	9:12 AM	9:32 AM	9:56 AM	9:57 AM	10:04 AM	10:07 AM	10:31 AM	10:51 AM	10:54 AM	
	9:18 AM			9:37 AM	10:01 AM			10:13 AM	10:37 AM			10:57 AM
3		9:19 AM	9:22 AM	9:42 AM	10:06 AM	10:07 AM	10:14 AM	10:17 AM	10:41 AM	11:01 AM	11:04 AM	
	9:28 AM			9:47 AM	10:11 AM			10:23 AM	10:47 AM			11:07 AM
4		9:29 AM	9:32 AM	9:52 AM	10:16 AM	10:17 AM	10:24 AM	10:27 AM	10:51 AM	11:11 AM	11:14 AM	

Core Headways: Eastbound: 5/5, Westbound: 6/4

Clearance time at Forest Park: 6"

Pocket track vacancy time at Emerson Park: 2"

trains: 11

Cycle time: 110"

Layover at Kenrick: 5", Emerson Park: 11" (7"+2" to/from pocket track + 2" at Emerson Park Station)

**BLUE ALTERNATIVE TO BUTLER HILL WITH EXISTING LAMBERT SCHEDULE (10-minute headway)**

Eastbound							Westbound					
BLUE Run Number	Lambert Main Terminal	BLUE Butler Hill	Shrewsbury	Forest Park	Emerson Park	Emerson Pocket	Emerson Pocket	Emerson Park	Forest Park	Shrewsbury	BLUE Butler Hill	Lambert Main Terminal
	7:08 AM			7:27 AM	7:51 AM			8:03 AM	8:27 AM			8:47 AM
1		6:57:42 AM	7:12 AM	7:32 AM	7:56 AM	7:57 AM	8:04 AM	8:08 AM	8:32 AM	8:52 AM	9:06:30 AM	
	7:18 AM			7:37 AM	8:01 AM			8:13 AM	8:37 AM			8:57 AM
2		7:07:42 AM	7:22 AM	7:42 AM	8:06 AM	8:07 AM	8:14 AM	8:18 AM	8:42 AM	9:02 AM	9:16:30 AM	
	7:28 AM			7:47 AM	8:11 AM			8:23 AM	8:47 AM			9:07 AM
3		7:17:42 AM	7:32 AM	7:52 AM	8:16 AM	8:17 AM	8:24 AM	8:28 AM	8:52 AM	9:12 AM	9:26:30 AM	
	7:38 AM			7:57 AM	8:21 AM			8:33 AM	8:57 AM			9:17 AM
4		7:27:42 AM	7:42 AM	8:02 AM	8:26 AM	8:27 AM	8:34 AM	8:38 AM	9:02 AM	9:22 AM	9:36:30 AM	
	7:48 AM			8:07 AM	8:31 AM			8:43 AM	9:07 AM			9:27 AM
5		7:37:42 AM	7:52 AM	8:12 AM	8:36 AM	8:37 AM	8:44 AM	8:48 AM	9:12 AM	9:32 AM	9:46:30 AM	
	7:58 AM			8:17 AM	8:41 AM			8:53 AM	9:17 AM			9:37 AM
6		7:47:42 AM	8:02 AM	8:22 AM	8:46 AM	8:47 AM	8:54 AM	8:58 AM	9:22 AM	9:42 AM	9:56:30 AM	
	8:08 AM			8:27 AM	8:51 AM			9:03 AM	9:27 AM			9:47 AM
7		7:57:42 AM	8:12 AM	8:32 AM	8:56 AM	8:57 AM	9:04 AM	9:08 AM	9:32 AM	9:52 AM	10:06:30 AM	
	8:18 AM			8:37 AM	9:01 AM			9:13 AM	9:37 AM			9:57 AM
8		8:07:42 AM	8:22 AM	8:42 AM	9:06 AM	9:07 AM	9:14 AM	9:18 AM	9:42 AM	10:02 AM	10:16:30 AM	
	8:28 AM			8:47 AM	9:11 AM			9:23 AM	9:47 AM			10:07 AM
9		8:17:42 AM	8:32 AM	8:52 AM	9:16 AM	9:17 AM	9:24 AM	9:28 AM	9:52 AM	10:12 AM	10:26:30 AM	
	8:38 AM			8:57 AM	9:21 AM			9:33 AM	9:57 AM			10:17 AM
10		8:27:42 AM	8:42 AM	9:02 AM	9:26 AM	9:27 AM	9:34 AM	9:38 AM	10:02 AM	10:22 AM	10:36:30 AM	
	8:48 AM			9:07 AM	9:31 AM			9:43 AM	10:07 AM			10:27 AM
11		8:37:42 AM	8:52 AM	9:12 AM	9:36 AM	9:37 AM	9:44 AM	9:48 AM	10:12 AM	10:32 AM	10:46:30 AM	
	8:58 AM			9:17 AM	9:41 AM			9:53 AM	10:17 AM			10:37 AM
12		8:47:42 AM	9:02 AM	9:22 AM	9:46 AM	9:47 AM	9:54 AM	9:58 AM	10:22 AM	10:42 AM	10:56:30 AM	
	9:08 AM			9:27 AM	9:51 AM			10:03 AM	10:27 AM			10:47 AM
13		8:57:42 AM	9:12 AM	9:32 AM	9:56 AM	9:57 AM	10:04 AM	10:08 AM	10:32 AM	10:52 AM	11:06:30 AM	
	9:18 AM			9:37 AM	10:01 AM			10:13 AM	10:37 AM			10:57 AM
14		9:07:42 AM	9:22 AM	9:42 AM	10:06 AM	10:07 AM	10:14 AM	10:18 AM	10:42 AM	11:02 AM	11:16:30 AM	
	9:28 AM			9:47 AM	10:11 AM			10:23 AM	10:47 AM			11:07 AM
1		9:17:42 AM	9:32 AM	9:52 AM	10:16 AM	10:17 AM	10:24 AM	10:28 AM	10:52 AM	11:12 AM	11:26:30 AM	

Core Headways: Eastbound: 5, Westbound: 5

Clearance time at Forest Park: 5"

Pocket track vacancy time at Emerson Park: 2"

Trains: 14

Cycle time: 140"

Layover at Butler Hill: 11", Emerson Park: 12" (7"+2" to/from pocket track + 3" at Emerson Park Station Westbound)

**BLUE ALTERNATIVE TO KENRICK WITH EXISTING LAMBERT SCHEDULE (10-minute headway)**

Eastbound							Westbound					
Blue Knrk Run Number	Lambert Main Terminal	BLUE Kenrick	Shrewsbury	Forest Park	Emerson Park	Emerson Pocket	Emerson Pocket	Emerson Park	Forest Park	Shrewsbury	BLUE Kenrick	Lambert Main Terminal
	7:08 AM			7:27 AM	7:51 AM			8:03 AM	8:27 AM			8:47 AM
1		7:09:30 AM	7:12 AM	7:32 AM	7:56 AM	7:57 AM	8:04 AM	8:08 AM	8:32 AM	8:52 AM	8:54:30 AM	
	7:18 AM			7:37 AM	8:01 AM			8:13 AM	8:37 AM			8:57 AM
2		7:19:30 AM	7:22 AM	7:42 AM	8:06 AM	8:07 AM	8:14 AM	8:18 AM	8:42 AM	9:02 AM	9:04:30 AM	
	7:28 AM			7:47 AM	8:11 AM			8:23 AM	8:47 AM			9:07 AM
3		7:29:30 AM	7:32 AM	7:52 AM	8:16 AM	8:17 AM	8:24 AM	8:28 AM	8:52 AM	9:12 AM	9:14:30 AM	
	7:38 AM			7:57 AM	8:21 AM			8:33 AM	8:57 AM			9:17 AM
4		7:39:30 AM	7:42 AM	8:02 AM	8:26 AM	8:27 AM	8:34 AM	8:38 AM	9:02 AM	9:22 AM	9:24:30 AM	
	7:48 AM			8:07 AM	8:31 AM			8:43 AM	9:07 AM			9:27 AM
5		7:49:30 AM	7:52 AM	8:12 AM	8:36 AM	8:37 AM	8:44 AM	8:48 AM	9:12 AM	9:32 AM	9:34:30 AM	
	7:58 AM			8:17 AM	8:41 AM			8:53 AM	9:17 AM			9:37 AM
6		7:59:30 AM	8:02 AM	8:22 AM	8:46 AM	8:47 AM	8:54 AM	8:58 AM	9:22 AM	9:42 AM	9:44:30 AM	
	8:08 AM			8:27 AM	8:51 AM			9:03 AM	9:27 AM			9:47 AM
7		8:09:30 AM	8:12 AM	8:32 AM	8:56 AM	8:57 AM	9:04 AM	9:08 AM	9:32 AM	9:52 AM	9:54:30 AM	
	8:18 AM			8:37 AM	9:01 AM			9:13 AM	9:37 AM			9:57 AM
8		8:19:30 AM	8:22 AM	8:42 AM	9:06 AM	9:07 AM	9:14 AM	9:18 AM	9:42 AM	10:02 AM	10:04:30 AM	
	8:28 AM			8:47 AM	9:11 AM			9:23 AM	9:47 AM			10:07 AM
9		8:29:30 AM	8:32 AM	8:52 AM	9:16 AM	9:17 AM	9:24 AM	9:28 AM	9:52 AM	10:12 AM	10:14:30 AM	
	8:38 AM			8:57 AM	9:21 AM			9:33 AM	9:57 AM			10:17 AM
10		8:39:30 AM	8:42 AM	9:02 AM	9:26 AM	9:27 AM	9:34 AM	9:38 AM	10:02 AM	10:22 AM	10:24:30 AM	
	8:48 AM			9:07 AM	9:31 AM			9:43 AM	10:07 AM			10:27 AM
11		8:49:30 AM	8:52 AM	9:12 AM	9:36 AM	9:37 AM	9:44 AM	9:48 AM	10:12 AM	10:32 AM	10:34:30 AM	
	8:58 AM			9:17 AM	9:41 AM			9:53 AM	10:17 AM			10:37 AM
1		8:59:30 AM	9:02 AM	9:22 AM	9:46 AM	9:47 AM	9:54 AM	9:58 AM	10:22 AM	10:42 AM	10:44:30 AM	
	9:08 AM			9:27 AM	9:51 AM			10:03 AM	10:27 AM			10:47 AM
2		9:09:30 AM	9:12 AM	9:32 AM	9:56 AM	9:57 AM	10:04 AM	10:08 AM	10:32 AM	10:52 AM	10:54:30 AM	
	9:18 AM			9:37 AM	10:01 AM			10:13 AM	10:37 AM			10:57 AM
3		9:19:30 AM	9:22 AM	9:42 AM	10:06 AM	10:07 AM	10:14 AM	10:18 AM	10:42 AM	11:02 AM	11:04:30 AM	
	9:28 AM			9:47 AM	10:11 AM			10:23 AM	10:47 AM			11:07 AM
4		9:29:30 AM	9:32 AM	9:52 AM	10:16 AM	10:17 AM	10:24 AM	10:28 AM	10:52 AM	11:12 AM	11:14:30 AM	

Core Headways: Eastbound: 5, Westbound: 5

Clearance time at Forest Park: 5"

Pocket track vacancy time at Emerson Park: 2"

trains: 11

Cycle time: 110"

Layover at Kenrick: 5", Emerson Park: 12" (7"+2" to/from pocket track + 3" at Emerson Park Station)

**ORANGE ALTERNATIVE TO BUTLER HILL WITH EXISTING LAMBERT SCHEDULE (10-minute headway)**

Eastbound							Westbound					
BLUE Run Number	Lambert Main Terminal	Orange Butler Hill	Shrewsbury	Forest Park	Emerson Park	Emerson Pocket	Emerson Pocket	Emerson Park	Forest Park	Shrewsbury	Orange Butler Hill	Lambert Main Terminal
	7:08 AM			7:27 AM	7:51 AM			8:03 AM	8:27 AM			8:47 AM
1		6:53:00 AM	7:12 AM	7:32 AM	7:56 AM	7:57 AM	8:04 AM	8:08 AM	8:32 AM	8:52 AM	9:11:00 AM	
	7:18 AM			7:37 AM	8:01 AM			8:13 AM	8:37 AM			8:57 AM
2		7:03:00 AM	7:22 AM	7:42 AM	8:06 AM	8:07 AM	8:14 AM	8:18 AM	8:42 AM	9:02 AM	9:21:00 AM	
	7:28 AM			7:47 AM	8:11 AM			8:23 AM	8:47 AM			9:07 AM
3		7:13:00 AM	7:32 AM	7:52 AM	8:16 AM	8:17 AM	8:24 AM	8:28 AM	8:52 AM	9:12 AM	9:31:00 AM	
	7:38 AM			7:57 AM	8:21 AM			8:33 AM	8:57 AM			9:17 AM
4		7:23:00 AM	7:42 AM	8:02 AM	8:26 AM	8:27 AM	8:34 AM	8:38 AM	9:02 AM	9:22 AM	9:41:00 AM	
	7:48 AM			8:07 AM	8:31 AM			8:43 AM	9:07 AM			9:27 AM
5		7:33:00 AM	7:52 AM	8:12 AM	8:36 AM	8:37 AM	8:44 AM	8:48 AM	9:12 AM	9:32 AM	9:51:00 AM	
	7:58 AM			8:17 AM	8:41 AM			8:53 AM	9:17 AM			9:37 AM
6		7:43:00 AM	8:02 AM	8:22 AM	8:46 AM	8:47 AM	8:54 AM	8:58 AM	9:22 AM	9:42 AM	10:01:00 AM	
	8:08 AM			8:27 AM	8:51 AM			9:03 AM	9:27 AM			9:47 AM
7		7:53:00 AM	8:12 AM	8:32 AM	8:56 AM	8:57 AM	9:04 AM	9:08 AM	9:32 AM	9:52 AM	10:11:00 AM	
	8:18 AM			8:37 AM	9:01 AM			9:13 AM	9:37 AM			9:57 AM
8		8:03:00 AM	8:22 AM	8:42 AM	9:06 AM	9:07 AM	9:14 AM	9:18 AM	9:42 AM	10:02 AM	10:21:00 AM	
	8:28 AM			8:47 AM	9:11 AM			9:23 AM	9:47 AM			10:07 AM
9		8:13:00 AM	8:32 AM	8:52 AM	9:16 AM	9:17 AM	9:24 AM	9:28 AM	9:52 AM	10:12 AM	10:31:00 AM	
	8:38 AM			8:57 AM	9:21 AM			9:33 AM	9:57 AM			10:17 AM
10		8:23:00 AM	8:42 AM	9:02 AM	9:26 AM	9:27 AM	9:34 AM	9:38 AM	10:02 AM	10:22 AM	10:41:00 AM	
	8:48 AM			9:07 AM	9:31 AM			9:43 AM	10:07 AM			10:27 AM
11		8:33:00 AM	8:52 AM	9:12 AM	9:36 AM	9:37 AM	9:44 AM	9:48 AM	10:12 AM	10:32 AM	10:51:00 AM	
	8:58 AM			9:17 AM	9:41 AM			9:53 AM	10:17 AM			10:37 AM
12		8:43:00 AM	9:02 AM	9:22 AM	9:46 AM	9:47 AM	9:54 AM	9:58 AM	10:22 AM	10:42 AM	11:01:00 AM	
	9:08 AM			9:27 AM	9:51 AM			10:03 AM	10:27 AM			10:47 AM
13		8:53:00 AM	9:12 AM	9:32 AM	9:56 AM	9:57 AM	10:04 AM	10:08 AM	10:32 AM	10:52 AM	11:11:00 AM	
	9:18 AM			9:37 AM	10:01 AM			10:13 AM	10:37 AM			10:57 AM
14		9:03:00 AM	9:22 AM	9:42 AM	10:06 AM	10:07 AM	10:14 AM	10:18 AM	10:42 AM	11:02 AM	11:21:00 AM	
	9:28 AM			9:47 AM	10:11 AM			10:23 AM	10:47 AM			11:07 AM
15		9:13:00 AM	9:32 AM	9:52 AM	10:16 AM	10:17 AM	10:24 AM	10:28 AM	10:52 AM	11:12 AM	11:31:00 AM	
	9:38 AM			9:57 AM	10:21 AM			10:33 AM	10:57 AM			11:17 AM
1		9:23:00 AM	9:42 AM	10:02 AM	10:26 AM	10:27 AM	10:34 AM	10:38 AM	11:02 AM	11:22 AM	11:41:00 AM	
	9:48 AM			10:07 AM	10:31 AM			10:43 AM	11:07 AM			11:27 AM
2		9:33:00 AM	9:52 AM	10:12 AM	10:36 AM	10:37 AM	10:44 AM	10:48 AM	11:12 AM	11:32 AM	11:51:00 AM	

Core Headways: Eastbound: 5", Westbound: 5"

Clearance time at Forest Park: 2"

Pocket track vacancy time at Emerson Park: 2"

Vehicles: 15

Cycle time: 150"

Layover at Butler Hill: 12", Emerson Park: 12" (7"+2" to/from pocket track + 3" at Emerson Pk Station Westbound)

**ORANGE ALTERNATIVE TO REAVIS BARRACKS WITH EXISTING LAMBERT SCHEDULE (10-minute headway)**

Eastbound							Westbound					
Orange R.E Run Number	Lambert Main Terminal	Orange Reavis Barracks	Shrewsbury	Forest Park	Emerson Park	Emerson Pocket	Emerson Pocket	Emerson Park	Forest Park	Shrewsbury	Orange Reavis Barracks	Lambert Main Terminal
	7:08 AM			7:27 AM	7:51 AM			8:03 AM	8:27 AM			8:46 AM
1		6:59:30 AM	7:12 AM	7:32 AM	7:56 AM	7:57 AM	8:04 AM	8:08 AM	8:32 AM	8:52 AM	9:04:30 AM	
	7:18 AM			7:37 AM	8:01 AM			8:13 AM	8:37 AM			8:56 AM
2		7:09:30 AM	7:22 AM	7:42 AM	8:06 AM	8:07 AM	8:14 AM	8:18 AM	8:42 AM	9:02 AM	9:14:30 AM	
	7:28 AM			7:47 AM	8:11 AM			8:23 AM	8:47 AM			9:06 AM
3		7:19:30 AM	7:32 AM	7:52 AM	8:16 AM	8:17 AM	8:24 AM	8:28 AM	8:52 AM	9:12 AM	9:24:30 AM	
	7:38 AM			7:57 AM	8:21 AM			8:33 AM	8:57 AM			9:16 AM
4		7:29:30 AM	7:42 AM	8:02 AM	8:26 AM	8:27 AM	8:34 AM	8:38 AM	9:02 AM	9:22 AM	9:34:30 AM	
	7:48 AM			8:07 AM	8:31 AM			8:43 AM	9:07 AM			9:26 AM
5		7:39:30 AM	7:52 AM	8:12 AM	8:36 AM	8:37 AM	8:44 AM	8:48 AM	9:12 AM	9:32 AM	9:44:30 AM	
	7:58 AM			8:17 AM	8:41 AM			8:53 AM	9:17 AM			9:36 AM
6		7:49:30 AM	8:02 AM	8:22 AM	8:46 AM	8:47 AM	8:54 AM	8:58 AM	9:22 AM	9:42 AM	9:54:30 AM	
	8:08 AM			8:27 AM	8:51 AM			9:03 AM	9:27 AM			9:46 AM
7		7:59:30 AM	8:12 AM	8:32 AM	8:56 AM	8:57 AM	9:04 AM	9:08 AM	9:32 AM	9:52 AM	10:04:30 AM	
	8:18 AM			8:37 AM	9:01 AM			9:13 AM	9:37 AM			9:56 AM
8		8:09:30 AM	8:22 AM	8:42 AM	9:06 AM	9:07 AM	9:14 AM	9:18 AM	9:42 AM	10:02 AM	10:14:30 AM	
	8:28 AM			8:47 AM	9:11 AM			9:23 AM	9:47 AM			10:06 AM
9		8:19:30 AM	8:32 AM	8:52 AM	9:16 AM	9:17 AM	9:24 AM	9:28 AM	9:52 AM	10:12 AM	10:24:30 AM	
	8:38 AM			8:57 AM	9:21 AM			9:33 AM	9:57 AM			10:16 AM
10		8:29:30 AM	8:42 AM	9:02 AM	9:26 AM	9:27 AM	9:34 AM	9:38 AM	10:02 AM	10:22 AM	10:34:30 AM	
	8:48 AM			9:07 AM	9:31 AM			9:43 AM	10:07 AM			10:26 AM
11		8:39:30 AM	8:52 AM	9:12 AM	9:36 AM	9:37 AM	9:44 AM	9:48 AM	10:12 AM	10:32 AM	10:44:30 AM	
	8:58 AM			9:17 AM	9:41 AM			9:53 AM	10:17 AM			10:36 AM
12		8:49:30 AM	9:02 AM	9:22 AM	9:46 AM	9:47 AM	9:54 AM	9:58 AM	10:22 AM	10:42 AM	10:54:30 AM	
	9:08 AM			9:27 AM	9:51 AM			10:03 AM	10:27 AM			10:46 AM
13		8:59:30 AM	9:12 AM	9:32 AM	9:56 AM	9:57 AM	10:04 AM	10:08 AM	10:32 AM	10:52 AM	11:04:30 AM	
	9:18 AM			9:37 AM	10:01 AM			10:13 AM	10:37 AM			10:56 AM
1		9:09:30 AM	9:22 AM	9:42 AM	10:06 AM	10:07 AM	10:14 AM	10:18 AM	10:42 AM	11:02 AM	11:14:30 AM	
	9:28 AM			9:47 AM	10:11 AM			10:23 AM	10:47 AM			11:06 AM
2		9:19:30 AM	9:32 AM	9:52 AM	10:16 AM	10:17 AM	10:24 AM	10:28 AM	10:52 AM	11:12 AM	11:24:30 AM	

Core Headways: Eastbound: 5, Westbound: 5

Clearance time at Forest Park: 5"

Pocket track vacancy time at Emerson Park: 2"

Trains: 13

Cycle time: 130"

Layover at Reavis Barracks: 5", Emerson Park: 12" (7"+2" to/from pocket track + 3" at Emerson Park station westbound)