Northside-Southside Study

Planning Transit Improvements for St. Louis City

Operations and Maintenance Plan

for

East-West Gateway Council of Governments

January, 2008

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St. Louis Northside-Southside Study
Operations and Maintenance Plan

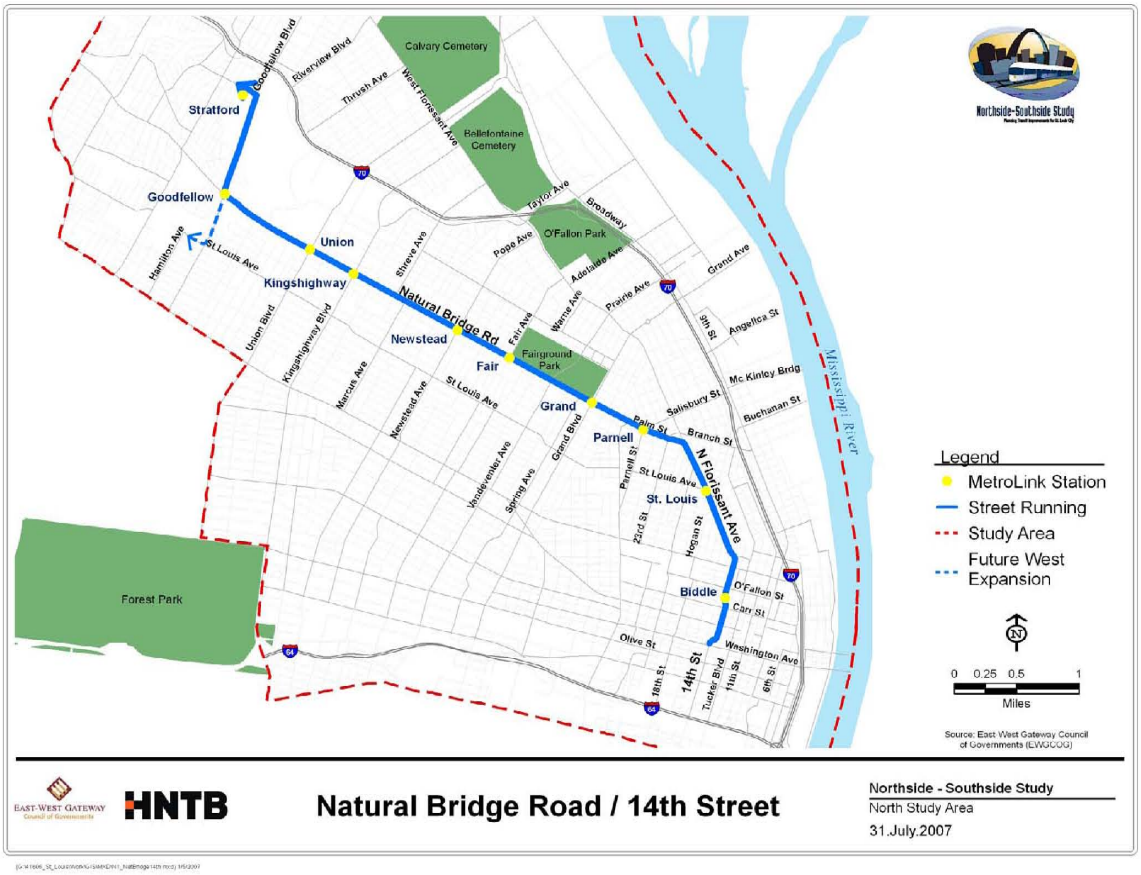
1.0 INTRODUCTION

The intent of an operations plan is to outline the levels of service and support for the build alternatives at each stage of implementation. In addition to the number of vehicles, operators, and other service specifics, the plan describes each alternative's impact on the rest of the MetroLink system. This also includes changes in the bus system in terms of replaced routes and the re-allocation of routes as a result of light rail implementation. Operating plans and their associated costs are provided for following scenarios and phasing options:

1. Transportation System Management (TSM) – System improvements (bus only) that would be required to satisfy demand along the alignment. TSM service would entail "skip-stop" bus service that serves the same light rail stop locations.
2. Light Rail Full Build – There are three light rail service sections on the proposed corridor with two different route alternatives. Each of the two alternatives includes the Natural Bridge Alignment on the north side and the downtown segment. The southern portion would include either the Jefferson or the Union Pacific Rail Road (UPRR) alternative.

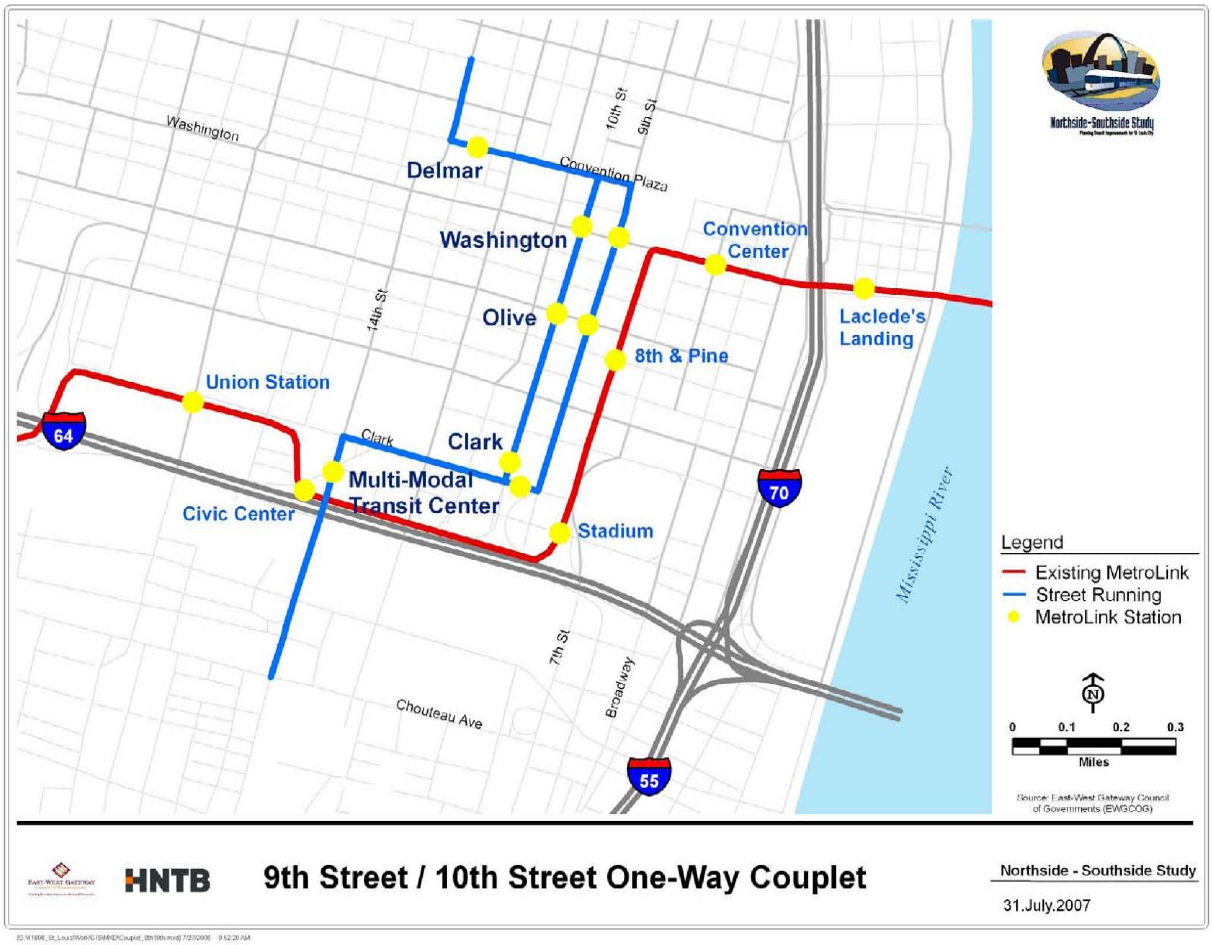
1.1 Light Rail Alignment

Figure 1.1: Northside Natural Bridge Alignment



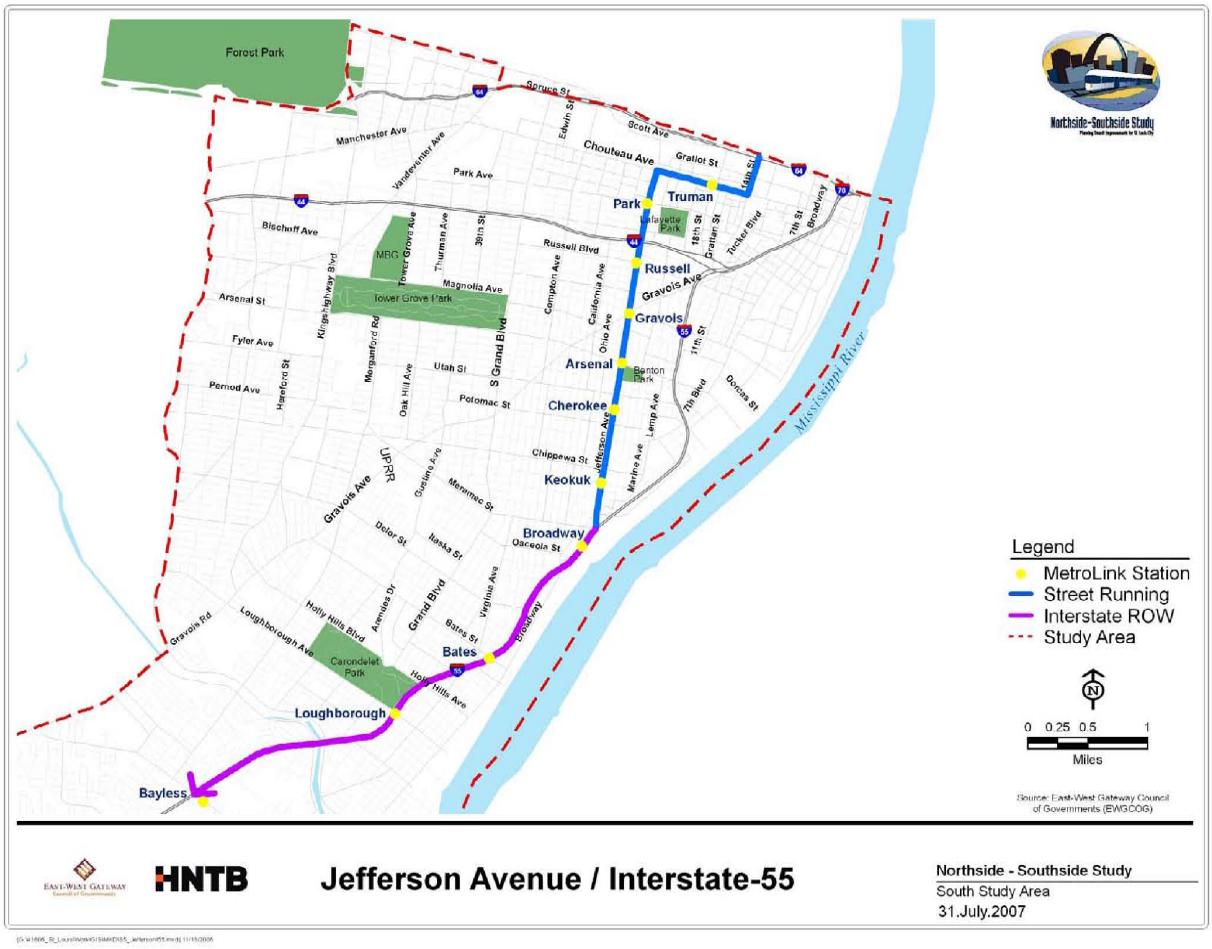
- The Natural Bridge Avenue LRT connects downtown St. Louis to I-70 at Goodfellow Boulevard and is approximately 6.8 miles in length. The alignment begins at the intersection of Convention Plaza and 14th Street on the north end of downtown St. Louis and proceeds north in the center of 14th Street to the intersection with North Florissant Avenue. The alignment then turns and proceeds northwest in the center median of North Florissant Avenue to the intersection with Palm Street. The alignment then turns and proceeds west in the center of Palm Street to Parnell Street where Palm Street turns into Natural Bridge Avenue. The alignment continues west in the center of Natural Bridge Avenue to the intersection with Goodfellow Blvd. The alignment then turns and proceeds north in the center of Goodfellow Blvd. Prior to Stratford Avenue the alignment elevates on retained fill and turns north on an elevated structure and terminates with a station and park-and-ride located at the intersection of Goodfellow Blvd. and Stratford Avenue.

Figure 1.2: Downtown Alignment



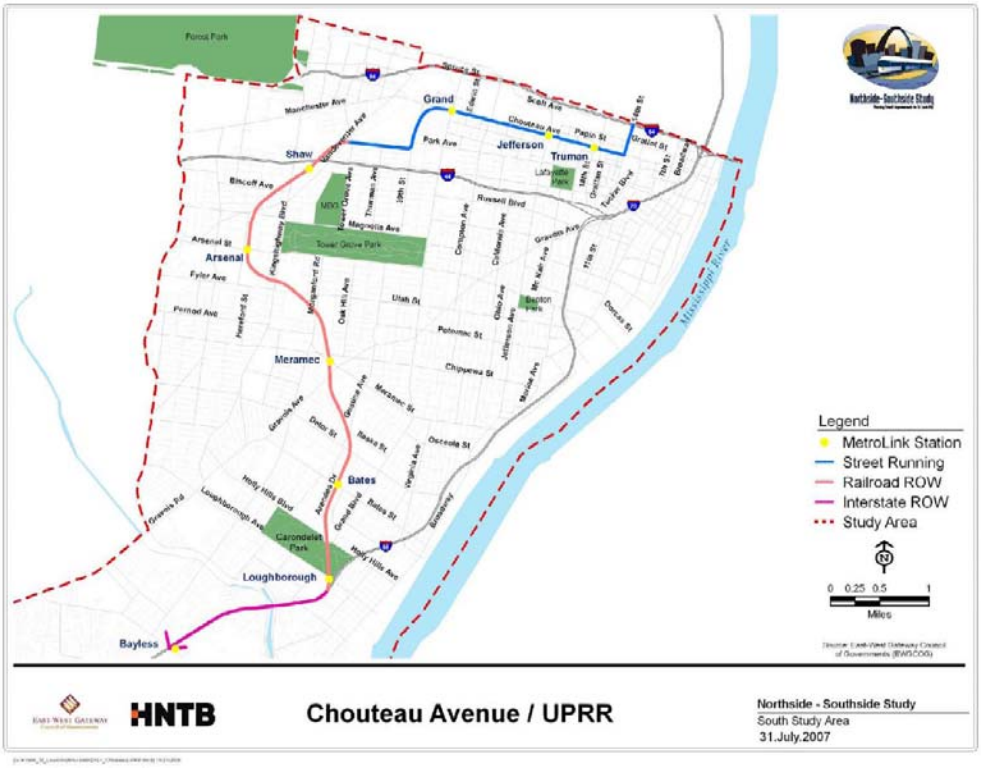
The downtown alignment connects Convention Plaza on the north side to the Multimodal Transit Center on the south side. The alignment begins at the intersection of Convention Plaza and 14th Street and proceeds east in the center of Convention Center Plaza to 9th and 10th Streets where it splits into a one-way couplet with a single track southbound on 10th and northbound on 9th. At Clark Street the tracks rejoin and proceed west on Clark Street to 14th Street At 14th, the alignment crosses the intersection and turns south into the Multimodal Transit Center and a proposed new platform.

Figure 1.3: Jefferson Avenue Alternative



The Jefferson Avenue alternative connects the Multimodal Transit Center to the I-55 corridor just south of the Bayless Avenue interchange and is approximately 8.6 miles in length. The alignment begins at the MMTC and proceeds south on the west side of the 14th Street bridge to Chouteau Avenue. At Chouteau, the alignment turns west and proceeds in the center of Chouteau Avenue to S. Jefferson Avenue. At Jefferson, the alignment turns south and proceeds down the center of S. Jefferson Avenue to where Jefferson converges with Broadway Street. At the intersection of Broadway and Gasconade Streets the alignment exits Broadway and enters the I-55 right-of-way. The alignment then proceeds south along the west side of I-55 to E Virginia Avenue where it elevates and crosses over I-55, proceeding down the east side of I-55 to its terminus at the proposed Bayless park-and-ride.

Figure 1.4: UPRR Alternative



- The UPRR alternative also connects the Multimodal Transit Center to the I-55 corridor just south of the Bayless Avenue interchange and is approximately 11.2 miles in length. The alignment begins at the MMTC and proceeds south on the west side of the 14th Street bridge to Chouteau Avenue. At Chouteau, the alignment turns west and proceeds in the center of Chouteau Ave to Spring Avenue. At Spring Avenue the alignment turns southwest to the intersection of Hickory Street and 39th Street. The alignment then turns and proceeds south in the center of 39th Street to Folsom Avenue. The alignment then turns and proceeds west in the center of Folsom to the UPRR right-of-way. Once in the UPRR right-of-way the alignment parallels the freight track and continues south to the I-55 corridor. At I-55, the alignment leaves the UPRR right-of-way and proceeds south along the east limits of the I-55 corridor to the terminus at the proposed Bayless park-and-ride.

1.2 Scenario Analysis

A key component to the operations plan is to provide a series of projected statistical information about each scenario that will help define its impact on service, costs and ridership. Fleet requirements, labor force needs, changes in the fixed route bus service were developed for the build-out scenario, as well as for each alternative alignment, based on a series of assumptions.

1. Level of Service Assumptions – Levels of service assumptions are required to accurately estimate the operating statistics of a particular scenario. They include the frequency of service during the course of a day and week, service hours on a daily basis and assumptions about holiday and weekend service.
2. Operations and Maintenance Cost Factors (O&M) – O&M costs are based on the number of vehicle revenue hours and the length of the facility. How these factors are used in the cost estimates is outlined in Section 4.1.

3. Impacts to other services – MetroLink will consider both re-allocation and reduction of bus service as a result of the implementation of the light rail. The operating costs associated with these bus changes will be quantified for each alternative.
4. Other projected statistics include the number of operators needed to operate the service, projected ridership and farebox return.

2.0 SERVICE PLANS

All project operations and maintenance (O&M) cost estimates are based on the assumed service parameters established by a service plan. Information regarding the level of service and travel time by time of day, service hours by day of week and running time for the route including layovers are outlined for each alternative.

2.1 Hours of Operation

The light rail will operate every day of the year with service hours that are consistent with the existing MetroLink light rail service. On weekdays, it will run from 5:00 am to 2:00 am. On Saturdays, Sundays and Holidays, it will run from 6:00 am to 2:00 am.

2.2 Frequency of Operation

The light rail's frequencies will also be similar to current frequencies on the existing light rail lines. These frequencies will be based on peak travel times in this corridor and are summarized below.

Weekdays

- 10 minute frequencies at peak (6:30 am – 9:30 am, 2:30 pm – 6:30 pm)
- 15 minute frequencies mid-day and early evening (9:30 am – 2:30 pm, 6:30 pm – 8:00 pm)
- 15 minute frequencies in the early morning hours (5:00 am – 6:30 am)
- 20 minute frequencies during late night (8:00 pm – 2:00 am)

20 minute frequencies are assumed all day on Saturdays, Sundays and Holidays. However, this level of service could be adjusted for certain special events.

2.3 Travel Speeds

The light rail will travel at maximum speeds of 35 miles per hour (MPH) throughout most of its alignment, while downtown sections would be limited to 10 MPH, parts of the UPRR Right-of-Way would allow 45 MPH, and sections along the interstate will support speeds up to 55 MPH.

2.4 Running Time

Travel time for the Natural Bridge section from the Goodfellow terminus to the O'Fallon Station would take approximately 16 ½ minutes and will account for a distance of 6.5 miles.

In downtown, the travel speed is slower because of urban conditions. Travel time for the downtown section from the O' Fallen Station to 14th Street is approximately 13 ½ minutes for a stretch of 2.1 miles.

Both the Jefferson Alignment and the UPRR Alignment Alternatives from 14th Street to Bayless/I-55 would take just over 19 minutes. This portion of the Jefferson Alternative travels for a total distance of 8.14 miles while the UPRR alternative south of 14th Street is 10 miles in length. Table 2.1 – 2.4 provides greater detail in the travel time between key stations.

Table 2.1: Travel Times between Light Rail Stops (in Minutes) for the Natural Bridge Alignment

	O'Fallon	Natural Bridge	Union	Kingshighway	Newstead	Fair	N. Grand	25th	N. Florissant	O'Fallon
Goodfellow	0.00	2.81	4.80	6.00	8.13	9.47	11.27	12.77	14.43	16.44
Natural Bridge	2.81	0.00	1.98	3.19	5.32	6.65	8.46	9.95	11.61	13.63
Union	4.80	1.98	0.00	1.20	3.33	4.67	6.47	7.97	9.63	11.65
Kingshighway	6.00	3.19	1.20	0.00	2.13	3.46	5.27	6.77	8.43	10.44
Newstead	8.13	5.32	3.33	2.13	0.00	1.33	3.14	4.64	6.30	8.31
Fair	9.47	6.65	4.67	3.46	1.33	0.00	1.81	3.30	4.96	6.98
N. Grand	11.27	8.46	6.47	5.27	3.14	1.81	0.00	1.50	3.16	5.17
25th	12.77	9.95	7.97	6.77	4.64	3.30	1.50	0.00	1.66	3.68
N. Florissant	14.43	11.61	9.63	8.43	6.3	4.96	3.16	1.66	0.00	2.02
O'Fallon	16.44	13.63	11.65	10.44	8.31	6.98	5.17	3.68	2.02	0.00

Table 2.2: Travel Times between Light Rail Stops (in Minutes) for the Downtown Alignment

	O'Fallon	Convention	10th & Washington	10th & Olive	10th & Clark	Multimodal	14th St.
O'Fallon	0.00	2.66	4.92	6.50	8.42	11.53	13.53
Convention	2.66	0.00	2.26	3.84	5.76	8.87	10.88
10th & Washington	4.92	2.26	0.00	1.58	3.50	6.61	8.61
10th & Olive	6.50	3.84	1.58	0.00	1.92	5.03	7.03
10th & Clark	8.42	5.76	3.50	1.92	0.00	3.11	5.11
Multimodal	11.53	8.87	6.61	5.03	3.11	0.00	2.00
14th St.	13.53	10.88	8.61	7.03	5.11	2.00	0.00

Table 2.3: Travel Times between Light Rail Stops (in Minutes) for the Jefferson Avenue Alignment Alternative

	14th St.	Mississippi	Park	Russell	Gravois	Arsenal	Cherokee	Chippewa	So. Broadway	Bates & Virginia	Lough-borough	Bayless/ I-55
14th St.	0.00	1.17	2.78	4.15	5.45	6.66	7.86	9.24	10.89	13.57	15.67	19.19
Mississippi	1.17	0.00	1.61	2.98	4.28	5.48	6.69	8.07	9.71	12.40	14.49	18.02
Park	2.78	1.61	0.00	1.37	2.67	3.87	5.08	6.46	8.10	10.79	12.88	16.41
Russell	4.15	2.98	1.37	0.00	1.30	2.51	3.71	5.09	6.74	9.42	11.52	15.04
Gravois	5.45	4.28	2.67	1.30	0.00	1.20	2.41	3.79	5.44	8.12	10.21	13.74
Arsenal	6.66	5.48	3.87	2.51	1.20	0.00	1.20	2.59	4.23	6.91	9.01	12.54
Cherokee	7.86	6.69	5.08	3.71	2.41	1.20	0.00	1.38	3.03	5.71	7.81	11.33
Chippewa	9.24	8.07	6.46	5.09	3.79	2.59	1.38	0.00	1.64	4.32	6.42	9.95
So. Broadway	10.89	9.71	8.10	6.74	5.44	4.23	3.03	1.64	0.00	2.68	4.78	8.31
Bates & Virginia	13.57	12.40	10.79	9.42	8.12	6.91	5.71	4.32	2.68	0.00	2.10	5.62
Loughborough	15.67	14.49	12.88	11.52	10.21	9.01	7.81	6.42	4.78	2.10	0.00	3.53
Bayless/ I-55	19.19	18.02	16.41	15.04	13.74	12.54	11.33	9.95	8.31	5.62	3.53	0.00

Table 2.4: Travel Times between Light Rail Stops (in Minutes) for the UPRR Alignment Alternative

	14th St.	Jefferson	Grand	Shaw	Arsenal	Meramec	Bates	Loughborough	Bayless/I-55
14th St.	0.00	1.79	4.02	6.64	8.73	11.35	13.77	15.61	19.14
Jefferson	1.79	0.00	2.23	4.86	6.95	9.57	11.98	13.82	17.35
Grand	4.02	2.23	0.00	2.62	4.71	7.33	9.75	11.59	15.11
Shaw	6.64	4.86	2.62	0.00	2.09	4.71	7.13	8.97	12.49
Arsenal	8.73	6.95	4.71	2.09	0.00	2.62	5.04	6.88	10.40
Meramec	11.35	9.57	7.33	4.71	2.62	0.00	2.42	4.26	7.78
Bates	13.77	11.98	9.75	7.13	5.04	2.42	0.00	1.84	5.36
Loughborough	15.61	13.82	11.59	8.97	6.88	4.26	1.84	0.00	3.53
Bayless/I-55	19.14	17.35	15.11	12.49	10.40	7.78	5.36	3.53	0.00

2.5 Layover Time

Layover time for passenger ingress and egress is included for all stops along the alignment in the estimated travel speeds. Longer layovers are assumed at the endpoints to account for operator rest, operator changes, and vehicle staging. The time for end of line layovers is included in the revenue hour calculations.

2.6 Volume to Capacity Ratio

LRT Vehicles have 40 seats per car, two cars per train for 80 seats. If six trains run per hour, there are 480 seats available per hour. Taking the peak ridership from the model results and dividing it by the 480 seats per hour yields the volume to capacity ratio.

Daily transit trips in 2030 will be 12,100 for the UPRR and 9,100 for the Jefferson Alternative. Assuming that the peak hour of the peak period is 11% of the total daily ridership, and that 75% of the boardings are on the southside line, the peak hour boardings in 2030 for the UPRR Alternative would be 998 for a 2.08 volume to capacity ratio. The peak hour boardings for the Jefferson Alternative would be 751 for a volume to capacity ratio of 1.56. Typical light rail transit vehicles are built for standees and their volume to capacity ratios are typically 2.25 or less. If ridership were to rise above this number, an increase in service for the peak hour may be considered.

2.7 Ridership

Table 2.5: Station Boardings

Jefferson Alternative		UPRR Alternative	
Goodfellow	500 + Riders	Goodfellow	500 + Riders
Newstead	1,000 + Riders	Newstead	1,000 + Riders
10th & Olive	500 + Riders	10th & Olive	500 + Riders
South Broadway	1,000 + Riders	Shaw	1,000 + Riders
Bayless-I-55	500 + Riders	Meramec	1,000 + Riders
		Loughborough	500 + Riders
		Bayless-I-55	1,000 + Riders

The estimated daily ridership for the year 2030 on the Jefferson Avenue section from the MMTC to the proposed Bayless park-and-ride is 9,100 rail boardings. Key stations are South Broadway and Newstead Ave at 1,000+ daily riders and Bayless/I-55, Goodfellow, and Tenth/Olive at 500+ daily riders.

The estimated daily ridership for the year 2030 on the UPRR section from the MMTC to the proposed Bayless park-and-ride is 12,100 rail boardings. Key stations are Bayless/I-55, Shaw, Newstead Avenue, and Meramec at 1,000+ daily riders and, Goodfellow, Tenth/Olive, and Loughborough at 500+ daily riders.

2.8 Vehicle Requirements

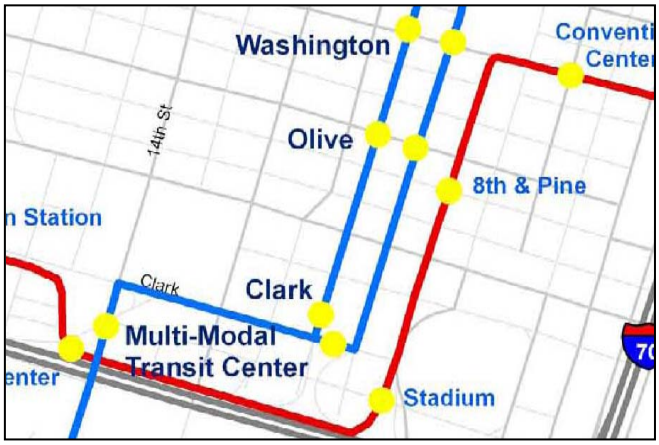
The entire light rail corridor should require fourteen fleet vehicles if the peak frequencies are 10 minutes, with a peak vehicle requirement of eleven. It is worth mentioning that the fleet vehicle calculation reflects the standard but conservative 20 percent spare vehicle addition to the peak vehicles.

Table 2.6 shows the vehicle requirements according to different levels of frequency. The highlighted rows show the level of service for peak service (10 min), off peak (15 min) and late evening service (20 min). See section 2.2 for more information on above service level assumptions

Table 2.6: Vehicle Requirements

Peak Frequency	Peak Vehicles	Spare Vehicles	Total Vehicles
5 min.	22	5	27
6 min.	19	4	23
8 min.	14	3	17
10 min.	11	3	14
12 min.	10	2	12
15 min.	8	2	10
20 min.	6	2	8

3.0 INTEGRATION WITH EXISTING AND PLANNED TRANSIT SYSTEM



The existing light rail east-west line shown in this illustration in red does not connect directly to the proposed line with a shared station platform. However, existing station stops downtown such as the Civic Center, Stadium, 8th & Pine, and the Convention Center are within a short walk of East-West Line access points. Pedestrian facilities between the multi-modal center and the nearest North-South line station at 14th Street will be design to facilitate the connection between the two rail lines and bus service.

Table 3.1: Natural Bridge Segment Transit Integration

Track Station	Cross Streets	Station Type	Comments
4015	14th & Biddle	Dual side	Connects with bus #32
4065	N. Florissant & St. Louis	Split side	Connects with bus #30, #74
4105	Parnell & Natural Bridge	Split side	Connects with bus #41
4130	N. Grand & Natural Bridge	Split side	Connects with bus #4, #70
4170	Fair & Natural Bridge	Split side	Connects with bus #4, #42
4195	N. Newstead & Natural Bridge	Split side	Connects with bus #4, #18, Proposed 120 stall park-and-ride.
4245	N. Kingshighway & Natural Bridge	Split side	Connects with bus #95
4265	Union & Natural Bridge	Split side	Connects with bus #4, #13
4305	Goodfellow & Natural Bridge	Center	Connects with bus #4, #30, #90 & Potential future west LRT extension.
4350	Goodfellow & Stratford	Center	Terminus – Connects with bus #16, #90, #174, #274x, Proposed park-and-ride.

Table 3.2: Downtown Segment Transit Integration

Track Station	Cross Streets	Station Type	Comments
5003	14th & Convention Plaza	Center	Adjacent to pocket track
5020	9th & 10th/Washington	Side	Couplet
5030	9th & 10th/Pine	Side	Couplet
5045	10th & Clark	Side	Couplet
5067	Multimodal Transit Center	Center	Connects to existing LRT

Table 3.3: Jefferson Alternative Alignment Transit Integration

Track Station	Cross Streets	Station Type	Comments
1035	Chouteau & Truman Parkway	Split side	Connects with bus #57
2015	Jefferson & Park	Center	Connects with bus #58x, #410x, #80
2040	Jefferson & Russell	Split side	Connects with bus #80
2065	Jefferson & Gravois	Split side	Connects with bus #10, #11x
2085	Jefferson & Arsenal	Split side	Connects with bus #30
2110	Jefferson & Cherokee	Split side	Connects with bus #73
2140	Jefferson & Keokuk	Split side	Connects with bus #11, #40
2170	I-55 Corridor	Center	Connects with bus #40, #70 & proposed 160 stall park-and-ride
2235	I-55 & Bates Interchange	Center	Connects with bus #8, #40, #73
2285	I-55 & Loughborough Interchange	Split side	Connects with bus #8, #70. Gated crossing.
2395	I-55 & Bayless Avenue interchange	Center	Terminus, Connects with bus #10x, 40x, 13x & 890 stall park-and-ride with a four-bay bus facility

Table 3.4: UPRR Alternative Alignment Transit Integration

Track Station	Cross Streets	Station Type	Comments
1035	Chouteau & Truman Parkway	Split side	Connects with bus #80
1065	Chouteau & Jefferson	Split side	Connects with bus #11
1120	Chouteau & Grand	In-line side	Connects with bus #57, #70
1245	UPRR & Shaw	Center	Connects with existing park-and-ride
1275	UPRR & Arsenal	Center	
1355	UPRR & Chippewa	Center	
1425	UPRR & Bates	Center	
1485	UPRR & Loughborough	Center	
2395	I-55 & Bayless Avenue interchange	Center	Terminus, Connects w/bus #10x, 40x, 13x & 890 stall park-and-ride with a four-bay bus facility

3.1 Pedestrian and Bicycle Connections

The Saint Louis area is in the process of connecting the Bi-State region with a mixture of multi-use trails and bicycle routes. Plans exist to eventually construct over 200 miles of interconnecting trails in the Bi-State region. And, on the Illinois side of the river, a 450 mile network of trails will extend to Chicago. These non-motorized corridors offer safe and convenient ways for light rail patrons to arrive at the stations without unnecessarily confronting heavy traffic conflicts. Along with the *Bike St. Louis* bicycle route in downtown St. Louis, several multi-use pathways cross or are within a short reach of the proposed light rail alignments; the Mississippi River Trail, the Christy Greenway, the River Des Peres Greenway, the St. Louis Riverfront Trail, and the Confluence Greenway.

3.2 Changes to Transit Service

In the fall of 2006 Metro redesigned its bus system in conjunction with the opening of the Cross County rail extension. This feeder bus plan utilizes the guiding principals of Metro Redefined 2006 to restructure the bus operations for this study and assumes that the operating budget will be constrained. Consequently, bus service in the area would be reconfigured to feed the rail line and new service provided only in limited areas. The bus routes were realigned to avoid duplication and redistribute resources. All alternatives

contain a downtown shuttle route to increase accessibility to the eastern core of the central business district and express routes truncated at terminal stations.

Natural Bridge Alignment

Table 3.5 lists all of the bus routes in the study area and describes any proposed changes from the No Build Alternative. The table also lists proposed peak and off-peak headways, and lists the rail station(s) that each route would feed.

Table 3.5: Primary Bus Route Changes for Natural Bridge Alignment

Route #	Name	Description of Change	Headway (min)		LRT Stations & Transit Centers Served
			Peak	Off-Peak	
4	Natural Bridge Shuttle	Between Grand & N. Hanley Station	30	60	All along NB
13	Union	Extend via Union	30	30	Union/NB
16	City Limits	Add station stop	20	30	Goodfellow/I-70
18	Taylor	Connect to Newstead Station	20	30	Newstead, CWE
30	Soulard	Deviate via Goodfellow/NB Station; re-route via Kienlen, St. Louis, Lucas Hunt to Rock Road station	30	30	Goodfellow/NB, St. Louis Ave
32	Wellston – M.L. King	Station stop	30	30	O' Fallon
41	Lee	Re-route via Jefferson to Civic Center station	20	30	Union/NB, Parnell,
42	Sarah	Add station stop	20	30	Grand, Fair Ave
70	Grand	Add station stop	7	12	Grand, Natural Bridge/Grand
74	Florissant	Re-routed St. Louis Ave, 20th to Carr to 14th	20	20	St. Louis Ave., CBD
90	Hampton	Deviate via Stratford to Goodfellow/I-70 Station	15	30	Goodfellow/NB, Goodfellow/I-70
95	Kingshighway	via Kingshighway/NB Station	10	15	CWE, Kingshighway/NB
174X	New Halls Ferry	Riverview to Lillian to Goodfellow		X	Goodfellow/I-70
274X	Paddock Hills	Lucas & Hunt Lillian to Goodfellow terminate at station		X	Goodfellow/I-70

Table 3.6 is a listing of all stations showing the bus routes that connect to each station. The most significant service changes include:

- Convention Plaza Station is proposed to be a large transit center so that north side buses will terminate and use MetroLink as a feeder system in downtown.
- St. Louis Avenue Station will be served by the #30 and #74 routes.
- Grand Station will be a focal point for two routes (#4, #70). The #4 Natural Bridge Shuttle will provide service from Grand to North Hanley along Natural Bridge Road. The #70 Grand will be a station stop and continue on Grand Avenue.
- I-70/Goodfellow Station will have parking and a transit center with 4 to 6 bus bays depending on land availability and site access. It will be served by four routes (#16, #90, #174X, #274X). Several express routes (174X, #274X) to downtown will be converted to feeder routes since the rail line would provide replacement service.

Table 3.6: Bus Route Changes by LRT Station for Natural Bridge Alignment

Station	Route No.	Route Name	Terminate or thru?	Notes
Convention Plaza		NS – CBD Alternative		
O'Fallon	32	M.L. King	thru	Station Stop
St. Louis Ave.	30	Soulard	thru	Re-route via Kienlen, St. Louis, Lucas Hunt to Rock Road Station
	74	Florissant	thru	Via 20th to Carr to 14th to Convention Plaza
Parnell	41	Lee	thru	Via Parnell to Jefferson to 14th St. TC
Grand	4	Natural Bridge Shuttle	thru	Shuttle between Grand & No. Hanley Station
	70	Grand	thru	via Grand
Fair	4	Natural Bridge Shuttle	thru	Shuttle between Grand & No. Hanley Station
	42	Sarah	thru	Station Stop
Newstead	4	Natural Bridge Shuttle	thru	Shuttle between Grand & No. Hanley Station
Newstead (Park-n-Ride)	18	Taylor	thru	Station Stop
Kingshighway	95	Kingshighway	thru	via Kingshighway
Union	4	Natural Bridge Shuttle	thru	Shuttle between Grand & No. Hanley Station
	13	Union	thru	
Goodfellow/NB	4	Natural Bridge Shuttle	thru	Shuttle between Grand & No. Hanley Station
	30	Soulard	thru	Re-route via Kienlen, St. Louis, Lucas Hunt to Rock Road Station
	90	Hampton	thru	Station Stop
Goodfellow/I-70 (Park-n-Ride)	16	City Limits	thru	via Stratford
Transit Center	90	Hampton	thru	Deviate via Stratford to Goodfellow/I-70 Station

Jefferson\ I-55 Alternative

Table 3.7 lists all of the bus routes in the study area and describes any proposed changes from the No Build Alternative. The table also lists proposed peak and off-peak headways, and lists the rail station(s) that each route would feed.

Table 3.7: Bus Route Proposed Changes for Jefferson Alignment

Route #	Name	Description of Change	Headway (min)		LRT Stations & Transit Centers Served
			Peak	Off-Peak	
8	Bates	Connect to Bates Station; loop of neighborhood	30	30	Loughborough, Bates,
10	Gravois	Extend from Hampton Loop to Gravois Station	8	20	Hampton Loop, Gravois
10X	South County Express	Terminate at Bayless Station;	20	x	Bayless
11	Chippewa	Terminate at station	20	40	Chippewa,
11X	Shrewsbury Express	via Gravois		x	Gravois
13	Union – Bayless	via Morganford to Bayless	30	30	Bayless
30	Soulard	Add station stop	30	30	CBD, Arsenal
40	South Broadway	Connect to South Broadway & Bates stations	30	30	S. Broadway, Bates, Chippewa
57	Manchester	via Chouteau to CBD	30	30	Mississippi, 14th
70	Grand-Loughborough	Continue south via Grand, E. on Loughborough	7	12	Grand, Loughborough
70	Grand-Meramec	existing routing			Grand , S. Broadway
73	Carondelet	Deviate to Cherokee and Bates Stations	30	30	Cherokee, Bates
80	Lafayette Square	Re-route via 14th St., Park, Grand, Russell, 7th, Park	30	30	Park, Russell
40X	I-55 X	Terminate at Bayless station		x	Bayless
58 X	Twin Oaks X	thru to CDB		x	Park
410X	Eureka X	thru to CDB		x	Park

Table 3.8 is a listing of all stations showing the bus routes that connect to each station.

The most significant service changes include:

- *Chippewa Station* will be served by two routes (#11, #40). The Chippewa route will terminate at the station since LRT service will be on Jefferson Avenue. The #40 will be a station stop and continue to serve South Broadway.

- *South Broadway station* will have parking and will be served by two routes (#40, #70).

- *Bayless Station:* It will be served by three routes. Several express routes (10X, 40X) to downtown will be converted to feeder routes since the rail line would provide replacement service: This station will have parking (800 to 1000 spaces) and a transit center with 4 to 6 bus bays.

Table 3.8: Bus Route Changes by LRT Station for Jefferson Alignment

Station	Route #	Route Name	Terminate or thru?	Notes
14th – Civic Center TC				
14th- Chouteau	57	Manchester	thru	via Chouteau to 14th TC
Mississippi	57	Manchester	thru	via Chouteau to 14th TC
Park	58 X	Twin Oaks X	thru	to CBD
	410X	Eureka X	thru	to CBD
	80	Lafayette Square	term.	via Tucker & Park
Russell	80	Lafayette Square	term.	Via Russell
Gravois	10	Gravois	thru	via Gravois to CBD
	11x	Shrewsbury X	thru	via Gravois
Arsenal	30	Soulard	thru	via Arsenal
Cherokee	73	Carondelet	thru	via Cherokee
Chippewa	11	Chippewa	term.	at station
	40	South Broadway	thru	at station
S. Broadway	40	South Broadway (Potential Park-Ride)	thru	via Broadway
	70	Grand (branch)	term	via Meramec
Bates & Virginia	8	Bates	thru	Shrewsbury, Hampton Loop, Bates
	40	South Broadway	thru	at station
	73	Carondelet	thru	at station
Loughborough	8	Bates	thru	at station
	70	Grand (branch)	term.	via Grand
Bayless/I-55	10X	South County X (Park-n-Ride)	term.	at station
	40X	I-55 X	term.	at station
	13	Union Morganford	term.	at station

Union Pacific Rail Road (UPRR) Alternative

Table 3.9 lists all of the bus routes in the study area and describes any proposed changes from the No Build Alternative. The table also lists proposed peak and off-peak headways, and lists the rail station(s) that each route would feed.

Table 3.9: Bus Route Proposed Changes for UPRR Alignment

Route #	Name	Description of Change	Headway (min)		LRT Stations & Transit Centers Served
			Peak	Off-Peak	
8	Bates	Connect to Bates Station;	30	30	Loughborough, Bates, Lansdowne
10	Gravois	Station stop	8	20	Hampton Loop, Gravois/Chippewa
10X	South County Express	Terminate at Bayless Station;		x	Bayless
11	Chippewa	Add station stop	20	40	Gravois/Chippewa, CBD
13	Union-Morganford	Link to stations	30	30	CWE, Shaw, Chippewa, Bayless
30	Soulard	Add station stops;	30	30	CBD, Arsenal
40	South Broadway	Connect to Loughborough station	30	30	Loughborough, 14th TC
40X	I-55 X	Terminate at Bayless station		x	Bayless
57	Manchester	Thru station Grand-Chouteau	30	30	Chouteau/Grand
59	Shaw Kirkwood	Add station stop	30	30	Shaw
70	Grand-Loughborough	Continue south via Grand, E. on Loughborough	7	12	Grand, Chouteau/Grand, Loughborough
70	Grand-Meramec	Existing routing	7	12	Grand , Chouteau/Grand
80	Lafayette Square	Add stop at stations, re-route via Park, 39th, Lafayette, Vandeventer, Shaw	30	30	Shaw, 14th/Chouteau
92	Macklind	Add stop at Shaw Station	40	40	CWE, Shaw, Hampton Loop
93	Lindell	Add stop at Shaw Station	30	30	Shaw
73	Carondelet	Deviate to Loughborough Station; then to CBD	30	30	Loughborough, CBD, Shaw
95	Kingshighway	Deviate via Shaw Station	10	15	CWE, Shaw

Table 3.10 is a listing of all stations showing the bus routes that connect to each station. The most significant service changes include:

- *Shaw Station* will be a connecting point for six routes (#13, #59, #80, #92, #93, #95) to utilize the current park-n-ride lot in close proximity to the Missouri Botanical Garden.

- *Chippewa\Gravois Station* will serve three major routes and is a possible small transit center. It will be a connecting point for the Chippewa and Gravois (#11 and #10).

- *Bayless Station:* Several express routes (10X, 40X) to downtown will be converted to feeder routes since the rail line would provide replacement service: This station will have parking (800 to 1000 spaces) and a transit center with 4 to 6 bus bays.

Table 3.10: Bus Route Changes by LRT Station for UPRR Alignment

Station	Route #	Name	Terminate or thru	Notes
Chouteau/14th	80	Lafayette Square	thru	
Chouteau/ Jefferson	11	Chippewa	thru	via Jefferson
Chouteau/Grand	57	Manchester	thru	via Chouteau to 14th TC
	70	Grand	thru	via Grand
Shaw (Park-n-Ride)	13	Union-Morganford	thru	deviate via Shaw then south on Morganford
	59	Shaw Kirkwood	thru	via Shaw
	80	Lafayette Square	term.	via Russell, Tower Grove, Shaw
	92	Macklind	thru	via Vandeventer
	95	Kingshighway	thru	deviate via Shaw
	93	Lindell	thru	via Shaw
Arsenal	30	Soulard	thru	via Arsenal
Chippewa / Gravois	13	Union-Morganford (Potential Transit Center)	thru	via south on Morganford to Bayless
	11	Chippewa	thru	via Chippewa
	10	Gravois	thru	via Gravois
Bates	8	Bates	thru	Shrewsbury, Hampton Loop, Bates Station
Loughborough	8	Bates	thru	Shrewsbury, Hampton Loop, Loughborough
	40	South Broadway	thru	deviate via Loughborough
	70	Grand (branch)	term.	via Grand
	73	Carondelet	thru	deviate via Loughborough
Bayless/I-55	10X	South County (Park-n-Ride)	term.	
	40X	I-55 X	term.	
	13	Union-Morganford	term.	via south on Morganford to Bayless

4.0 OPERATIONS AND MAINTENANCE COSTS

Operation and maintenance costs estimates were based on early concept designs and are broad figures that need further refining as the project moves to the next phase of the project development process.

The level of service for peak and off-peak service was established in Section 2.2. It was based on the service level of the existing East-West line and planning judgment cut/past assumption.

The level of service was tested and deemed to be sufficient based off model-generated boarding in Section 2.8. We assumed six trains at peak hour to accommodate boardings with a volume to capacity ratio of 2.09 – 2.77. Newstead is expected to be the busiest station,

The FTA annualization factor translated the level of service on a weekday to annual number given that Saturday and Sunday have a lower level of service. Based on a national average, FTA allows the factor of 305 days a year unless the transit system can show higher level of service on weekends.

Table 4.1: Daily Revenue Hours

Time of Day	# Hours	# Trains	# Revenue Hours
Peak	7	14	98
Off-Peak	8	10	80
Late Night	6	8	48
			226

Using the annualization factor, the weekday daily revenue hours shown in Table 4.1 generate *68,930 Annual Revenue Hours*. The 2004 estimated cost per revenue hour for the existing St. Louis LRT was $244.72, which can be converted to $263.54 using a 2.5% inflation rate. This can be used to predict the estimated annual operations and maintenance costs to be approximately $18,165,812.

Cost Methodology does not differentiate between the two alternative alignments as each had the same operating time and assumed similar annual revenue hours for the purpose of this cost estimation. Some factors that may nominally increase the cost of the UPRR Alternative because of its greater track length include the maintenance of stops, at grade crossings, and consumables such as energy use.

Table 2.1: Travel Times between Light Rail Stops (in Minutes) for the Natural Bridge Alignment

	O'Fallon	Natural Bridge	Union	Kingshighway	Newstead	Fair	N. Grand	25th	N. Florissant	O'Fallon
Goodfellow	0.00	2.81	4.80	6.00	8.13	9.47	11.27	12.77	14.43	16.44
Natural Bridge	2.81	0.00	1.98	3.19	5.32	6.65	8.46	9.95	11.61	13.63
Union	4.80	1.98	0.00	1.20	3.33	4.67	6.47	7.97	9.63	11.65
Kingshighway	6.00	3.19	1.20	0.00	2.13	3.46	5.27	6.77	8.43	10.44
Newstead	8.13	5.32	3.33	2.13	0.00	1.33	3.14	4.64	6.30	8.31
Fair	9.47	6.65	4.67	3.46	1.33	0.00	1.81	3.30	4.96	6.98
N. Grand	11.27	8.46	6.47	5.27	3.14	1.81	0.00	1.50	3.16	5.17
25th	12.77	9.95	7.97	6.77	4.64	3.30	1.50	0.00	1.66	3.68
N. Florissant	14.43	11.61	9.63	8.43	6.3	4.96	3.16	1.66	0.00	2.02
O'Fallon	16.44	13.63	11.65	10.44	8.31	6.98	5.17	3.68	2.02	0.00

Table 2.2: Travel Times between Light Rail Stops (in Minutes) for the Downtown Alignment

	O'Fallon	Convention	10th & Washington	10th & Olive	10th & Clark	Multimodal	14th St.
O'Fallon	0.00	2.66	4.92	6.50	8.42	11.53	13.53
Convention	2.66	0.00	2.26	3.84	5.76	8.87	10.88
10th & Washington	4.92	2.26	0.00	1.58	3.50	6.61	8.61
10th & Olive	6.50	3.84	1.58	0.00	1.92	5.03	7.03
10th & Clark	8.42	5.76	3.50	1.92	0.00	3.11	5.11
Multimodal	11.53	8.87	6.61	5.03	3.11	0.00	2.00
14th St.	13.53	10.88	8.61	7.03	5.11	2.00	0.00

Table 2.3: Travel Times between Light Rail Stops (in Minutes) for the Jefferson Avenue Alignment Alternative

	14th St.	Mississippi	Park	Russell	Gravois	Arsenal	Cherokee	Chippewa	So. Broadway	Bates & Virginia	Lough-borough	Bayless/ I-55
14th St.	0.00	1.17	2.78	4.15	5.45	6.66	7.86	9.24	10.89	13.57	15.67	19.19
Mississippi	1.17	0.00	1.61	2.98	4.28	5.48	6.69	8.07	9.71	12.40	14.49	18.02
Park	2.78	1.61	0.00	1.37	2.67	3.87	5.08	6.46	8.10	10.79	12.88	16.41
Russell	4.15	2.98	1.37	0.00	1.30	2.51	3.71	5.09	6.74	9.42	11.52	15.04
Gravois	5.45	4.28	2.67	1.30	0.00	1.20	2.41	3.79	5.44	8.12	10.21	13.74
Arsenal	6.66	5.48	3.87	2.51	1.20	0.00	1.20	2.59	4.23	6.91	9.01	12.54
Cherokee	7.86	6.69	5.08	3.71	2.41	1.20	0.00	1.38	3.03	5.71	7.81	11.33
Chippewa	9.24	8.07	6.46	5.09	3.79	2.59	1.38	0.00	1.64	4.32	6.42	9.95
So. Broadway	10.89	9.71	8.10	6.74	5.44	4.23	3.03	1.64	0.00	2.68	4.78	8.31
Bates & Virginia	13.57	12.40	10.79	9.42	8.12	6.91	5.71	4.32	2.68	0.00	2.10	5.62
Loughborough	15.67	14.49	12.88	11.52	10.21	9.01	7.81	6.42	4.78	2.10	0.00	3.53
Bayless/ I-55	19.19	18.02	16.41	15.04	13.74	12.54	11.33	9.95	8.31	5.62	3.53	0.00

Table 2.4: Travel Times between Light Rail Stops (in Minutes) for the UPRR Alignment Alternative

	14th St.	Jefferson	Grand	Shaw	Arsenal	Meramec	Bates	Loughborough	Bayless/I-55
14th St.	0.00	1.79	4.02	6.64	8.73	11.35	13.77	15.61	19.14
Jefferson	1.79	0.00	2.23	4.86	6.95	9.57	11.98	13.82	17.35
Grand	4.02	2.23	0.00	2.62	4.71	7.33	9.75	11.59	15.11
Shaw	6.64	4.86	2.62	0.00	2.09	4.71	7.13	8.97	12.49
Arsenal	8.73	6.95	4.71	2.09	0.00	2.62	5.04	6.88	10.40
Meramec	11.35	9.57	7.33	4.71	2.62	0.00	2.42	4.26	7.78
Bates	13.77	11.98	9.75	7.13	5.04	2.42	0.00	1.84	5.36
Loughborough	15.61	13.82	11.59	8.97	6.88	4.26	1.84	0.00	3.53
Bayless/I-55	19.14	17.35	15.11	12.49	10.40	7.78	5.36	3.53	0.00