SPOKANE REGIONAL LIGHT RAIL PROJECT
"Single Track Option" - Plaza to Liberty Lake
December 15, 2004

Executive Summary

The Spokane Regional Light Rail Project previously developed conceptual engineering for several alternatives which are included in a Draft Environmental Impact Statement (DEIS) document that is currently in preparation. Those alternatives include:

- Separate Track Alternative – Full double track light rail from downtown Spokane to Liberty Lake entirely separated from the tracks of adjacent railroads. Includes several grade-separated crossings and LRT stations and finishes consistent in scale with other recently developed light rail systems such as Portland, Oregon. Assumes electrified two-car train operations.

- Shared Track Alternative – Scaled down system, including a section of alignment that shares tracks with the existing UPRR. Includes no new grade-separations, downscaled station and finish design and diesel light rail vehicles (DMUs) operating in two-car trains.

- U-City Light Rail Alternative (MOS) – Further scaled down system with light rail from downtown Spokane to University City, considered a minimum operable segment (MOS) for light rail. Includes a more extensive section shared-track alignment with UPRR, further reduced allowance for collateral construction, stations and finishes, and single-car operations of diesel light rail vehicles. Includes bus rapid transit (BRT) serving the corridor from University City to Liberty Lake.

- Bus Rapid Transit Alternative (BRT) – Bus Rapid Transit serving the entire South Valley Corridor from downtown Spokane to Liberty Lake utilizing primarily existing roadways. Includes special premium vehicles, queue bypass treatments at congested intersections, traffic signal priority treatments and special "stations" for passenger boarding/alighting.

The evolution of the project development process has in part focused on defining ways to reduce the cost of alternatives for development while providing a high capacity transit alternative that satisfies the purpose and need for the project. Following the development of the MOS Alternative, a desire for the application of it's low-cost assumptions to the entire South Valley Corridor from downtown Spokane to Liberty Lake was identified. This document reports on the results of initial consideration of cost that applies the MOS assumptions to the entire corridor.

It identifies an estimated capital cost of $226.5 in year 2008 mid-point of expenditure dollars for the development of the system, and an annual cost of $5.6 for operations and maintenance of the system.

1.0 Conceptual Operating Plan

Operating plans must reflect realistic estimates of running times, corresponding to the civil constraints of proposed alignments, and the performance characteristics of vehicles and support systems. In addition, they must support policy levels of service, and provide carrying capacity sufficient to meet ridership projections. Individually, changes to any of these parameters may have a significant effect on operations and operating statistics, fleet size, staffing, and overall operating and maintenance costs.

1.1 General Alignment Configuration and Operating Assumptions

This section describes the assumptions on which the Conceptual Operating Plan for the Single Track Option is based.

1. ***Hours of Service:*** 5:00 AM until 11:00 PM, seven days per week.

2. ***Policy Headways:*** Planning is based on a) 15-minute peak headways during most of the operating day, Mondays through Saturdays, and b) 30-minute headways for early morning and late evening service on those days, and all day on Sundays.

3. ***Train Consists:*** It is assumed all trains will operate with one articulated diesel light rail vehicle, also referred to as diesel multiple unit (DMU) vehicle.

4. ***Vehicle Capacity:*** The DMU design capacity, for vehicle and testing purposes, is based on a full, seated load and 2.5 square feet of area for each standee, for a maximum passenger loading of approximately 190 people. Experience has shown that this degree of loading is only achievable and sustainable in the very densest transit corridors, and a practical capacity for sizing purposes for most applications is approximately 135 to 150 per articulated vehicle.

5. ***Stations:*** Thirteen stations between Plaza (downtown) and Signal Road (Liberty Lake), as follows: Plaza, Convention Center, Trent, Napa, East Central (Freya), Fairground, Argonne, University, Pines, Evergreen, Sullivan, Appleway and Signal Road.

6. ***Alignment and Support Systems:*** As described in other documents on alignment and facility designs; basically:

    - Reserved lane(s) in street (Riverside Avenue), Plaza to west of Trent
    - North of BNSF railroad r-o-w, west of Trent to Madelia
    - Reserved lane(s) in street, south on Madelia and east on Riverside Avenue to UPRR r-o-w
    - Shared track on UPRR r-o-w, Riverside/UPRR to Dishman-Mica Road
    - Private r-o-w along south side of Appleway Blvd, Dishman-Mica Road to south of I-90
    - Private r-o-w , from south of I-90 to east end of line at Signal Road

1.2 One-Way, Round Trip and Operating Cycle Times

Terminal-to-terminal run time is estimated to be 37.0 minutes, for a round trip running time of 74 minutes (Tables 1 and 2). Terminal layovers of seven to nine minutes are provided at each end of the line for operator rest and schedule recovery. Total layover time is 16 minutes per cycle (22% of running time), and produces a complete round trip operating cycle of 90 minutes. This provides adequate recovery time and fits with the schedule of 15-minute policy headways.

1.3 Number of Trains in Service and Fleet Size

Based on the foregoing assumptions and operating time estimates, a 90-minute cycle will require that six trains be in service to achieve the target peak headway of 15 minutes between trains. With all peak trains assumed to consist of one DMU, there would be six (6) cars in service, providing a practical capacity of 500-600 passengers per hour per direction. Adding a "spares" margin of 20% for cars to be held in reserve and undergoing maintenance, as is common industry practice, leads to a total fleet estimate of eight (8) DMU vehicles.

Tables 3-A and 3-B present a portion of a timetable sufficient to show the desired schedule and develop the required number of trains in service. Highlighted in bold are the locations of meets between trains operating in opposite directions. Table 3-A has trains leaving each end of the line on the quarter hour. Of five meets, only two - at Trent and Appleway - would be in stations, with each westbound train leaving at the moment an eastbound train arrives. The three middle meets would not be at stations, but 0.5 minutes west of East Central, Argonne and Evergreen.

In Table 3-B, westbound trains have been shifted to depart from Signal Road at one minute past the quarter hour (0:01, 0:16, 0:31, 0:46). The effect is to place all meets at stations: Trent, East Central, Argonne, Evergreen and Appleway. At East Central, Argonne and Evergreen, each westbound train would leave at the moment an eastbound train arrives. At Trent and Appleway, each eastbound train would leave at the moment a westbound train arrives.

With the Table 3-B timetable, all meets are at stations, and passing sidings can be short (Figure 1) and designed to straddle an island platform at each of the five stations where meets occur. This schedule should work well under normal operating conditions. However, catching up when there are delays will be more difficult than would be the case on a system with longer sidings or substantial sections of double track. When delays are significant, it occasionally will be necessary to have trains "fall back" one or more headways to get the system back on schedule; but this should be a rare event.

Table 1

SPOKANE REGIONAL LIGHT RAIL PROJECT

"Single-Track Option" ; DMU Shared Track, Plaza to Liberty Lake

Preliminary Travel Time Estimate

Station	Outbound (Read Down)			Inbound (Read Up)		
	Travel Time	Dwell Time	Cumulative	Travel Time	Dwell Time	Cumulative
Plaza					0	2220
	90		90	90		2220
Convention Center		30	120		30	2130
	90		210	90		2100
Trent		30	240		30	2010
	240		480	240		1980
Napa		30	510		30	1740
	180		690	180		1710
East Central (Freya)		30	720		30	1530
	90		810	90		1500
Fairground		30	840		30	1410
	300		1140	300		1380
Argonne		30	1170		30	1080
	120		1290	120		1050
University		30	1320		30	930
	120		1440	120		900
Pines		30	1470		30	780
	120		1590	120		750
Evergreen		30	1620		30	630
	120		1740	120		600
Sullivan		30	1770		30	480
	240		2010	240		450
Appleway		30	2040		30	210
	180		2220	180		180
Signal Road		0	2220			
Total (Seconds)	1890	330	2220	1890	330	2220
Total (Minutes)	31.5	5.5	37.0	31.5	5.5	37.0
Commercial Speed (mph), 15.66 miles one-way			25.4			25.4

Table 2

SPOKANE REGIONAL LIGHT RAIL PROJECT

"Single-Track Option" : DMU Shared Track, Plaza to Liberty Lakw; 15-Minute headways

Approximate Travel Time between Stations (in Minutres)

Stations	Plaza	Convention Ctr	Trent	Napa	East Central	Fairground	Argonne	University	Pines	Evergreen	Sullivan	Appleway	Signal Road
Plaza		1.5	3.5	8.0	11.5	13.5	19.0	21.5	24.0	26.5	29.0	33.5	37.0
Convention Ctr	2.0		2.0	6.5	10.0	12.0	17.5	20.0	22.5	25.0	27.5	32.0	35.5
Trent	4.0	2.0		4.5	8.0	10.0	15.5	18.0	20.5	23.0	25.5	30.0	33.5
Napa	8.5	6.5	4.5		3.5	5.5	11.0	13.5	16.0	18.5	21.0	25.5	29.0
East Central	12.0	10.0	8.0	3.5		2.0	7.5	10.0	12.5	15.0	17.5	22.0	25.5
Fairground	14.0	12.0	10.0	5.5	2.0		5.5	8.0	10.5	13.0	15.5	20.0	23.5
Argonne	19.5	17.5	15.5	11.0	7.5	5.5		2.5	5.0	7.5	10.0	14.5	18.0
University	22.0	20.0	18.0	13.5	10.0	8.0	2.5		2.5	5/0	7.5	12.0	15.5
Pines	24.5	22.5	20.5	16.0	12.5	10.5	5.0	2.5		2.5	5.0	9.5	13.0
Evergreen	27.0	25.0	23.0	18.5	15.0	13.0	7.5	5.0	2.5		2.5	7.0	10.5
Sullivan	29.5	27.5	25.5	21.0	17.5	15.5	10.0	7.5	5.0	2.5		4.5	8.0
Appleway	34.0	32.0	30.0	25.5	22.0	20.0	14.5	12.0	9.5	7.0	4.5		3.5
Signal Road	37.0	35.0	33.0	28.5	25.0	23.0	17.5	15.0	12.5	10.0	7.5	3.0	

Table 3-A

SPOKANE REGIONAL LIGHT RAIL PROJECT
"Single-Track Option" : DMU Shared Track, Plaza to Liberty Lake; 15-Minute Headways
Timetable Fragment Showing Meets; 90-Minute Cycle, 6 Trains, 5 Meets/Run, 37-Minute 1-Way Run
Departures on Quarter Hour from Both Ends of Line

Outbound (Read Down)							Stations		Inbound (Read Up)					
A1	*B2*	*C2*	*D2*	*E2*	*F2*		*Trainset/Run#*		*B1*	*C1*	*D1*	*E1*	*F1*	*A2*
10:00:00	10:15:00	10:30:00	10:45:00	11:00:00	11:15:00	lv	Plaza	ar	10:07:00	10:22:00	10:37:00	10:52:00	11:07:00	11:22:00
10:01:30	10:16:30	10:31:30	10:46:30	11:01:30	11:16:30	ar	Convention Ctr	lv	10:05:30	10:20:30	10:35:30	10:50:30	11:05:30	11:20:30
10:02:00	10:17:00	10:32:00	10:47:00	11:02:00	11:17:00	lv	"	ar	10:05:00	10:20:00	10:35:00	10:50:00	11:05:00	11:20:00
10:03:30	**10:18:30**	**10:33:30**	**10:48:30**	**11:03:30**	**11:18:30**	ar	Trent	lv	**10:03:30**	**10:18:30**	**10:33:30**	**10:48:30**	**11:03:30**	**11:18:30**
10:04:00	10:19:00	10:34:00	10:49:00	11:04:00	11:19:00	lv	"	ar	10:03:00	10:18:00	10:33:00	10:48:00	11:03:00	11:18:00
10:08:00	10:23:00	10:38:00	10:53:00	11:08:00	11:23:00	ar	Napa	lv	9:59:00	10:14:00	10:29:00	10:44:00	10:59:00	11:14:00
10:08:30	***10:23:30***	***10:38:30***	***10:53:30***	***11:08:30***	***11:23:30***	lv	"	ar	***9:58:30***	***10:13:30***	***10:28:30***	***10:43:30***	***10:58:30***	***11:13:30***
10:11:30	***10:26:30***	***10:41:30***	***10:56:30***	***11:11:30***	***11:26:30***	ar	East Central	lv	***9:55:30***	***10:10:30***	***10:25:30***	***10:40:30***	***10:55:30***	***11:10:30***
10:12:00	10:27:00	10:42:00	10:57:00	11:12:00	11:27:00	lv	"	ar	9:55:00	10:10:00	10:25:00	10:40:00	10:55:00	11:10:00
10:13:30	10:28:30	10:43:30	10:58:30	11:13:30	11:28:30	ar	Fairground	lv	9:53:30	10:08:30	10:23:30	10:38:30	10:53:30	11:08:30
10:14:00	***10:29:00***	***10:44:00***	***10:59:00***	***11:14:00***	***11:29:00***	lv	"	ar	***9:53:00***	***10:08:00***	***10:23:00***	***10:38:00***	***10:53:00***	***11:08:00***
10:19:00	***10:34:00***	***10:49:00***	***11:04:00***	***11:19:00***	***11:34:00***	ar	Argonne	lv	***9:48:00***	***10:03:00***	***10:18:00***	***10:33:00***	***10:48:00***	***11:03:00***
10:19:30	10:34:30	10:49:30	11:04:30	11:19:30	11:34:30	lv	"	ar	9:47:30	10:02:30	10:17:30	10:32:30	10:47:30	11:02:30
10:21:30	10:36:30	10:51:30	11:06:30	11:21:30	11:36:30	ar	University	lv	9:45:30	10:00:30	10:15:30	10:30:30	10:45:30	11:00:30
10:22:00	10:37:00	10:52:00	11:07:00	11:22:00	11:37:00	lv	"	ar	9:45:00	10:00:00	10:15:00	10:30:00	10:45:00	11:00:00
10:24:00	10:39:00	10:54:00	11:09:00	11:24:00	11:39:00	ar	Pines	lv	9:43:00	9:58:00	10:13:00	10:28:00	10:43:00	10:58:00
10:24:30	***10:39:30***	***10:54:30***	***11:09:30***	***11:24:30***	***11:39:30***	lv	"	ar	***9:42:30***	***9:57:30***	***10:12:30***	***10:27:30***	***10:42:30***	***10:57:30***
10:26:30	***10:41:30***	***10:56:30***	***11:11:30***	***11:26:30***	***11:41:30***	ar	Evergreen	lv	***9:40:30***	***9:55:30***	***10:10:30***	***10:25:30***	***10:40:30***	***10:55:30***
10:27:00	10:42:00	10:57:00	11:12:00	11:27:00	11:42:00	lv	"	ar	9:40:00	9:55:00	10:10:00	10:25:00	10:40:00	10:55:00
10:29:00	10:44:00	10:59:00	11:14:00	11:29:00	11:44:00	ar	Sullivan	lv	9:38:00	9:53:00	10:08:00	10:23:00	10:38:00	10:53:00
10:29:30	10:44:30	10:59:30	11:14:30	11:29:30	11:44:30	lv	"	ar	9:37:30	9:52:30	10:07:30	10:22:30	10:37:30	10:52:30
10:33:30	**10:48:30**	**11:03:30**	**11:18:30**	**11:33:30**	**11:48:30**	ar	Appleway	lv	**9:33:30**	**9:48:30**	**10:03:30**	**10:18:30**	**10:33:30**	**10:48:30**
10:34:00	10:49:00	11:04:00	11:19:00	11:34:00	11:49:00	lv	"	ar	9:33:00	9:48:00	10:03:00	10:18:00	10:33:00	10:48:00
10:37:00	10:52:00	11:07:00	11:22:00	11:37:00	11:52:00	ar	Signal Rd	lv	9:30:00	9:45:00	10:00:00	10:15:00	10:30:00	10:45:00

Note: Meet locations in **bold**. Terminal layovers: Plaza 8 mins; Signal Rd 8 mins. Operating Cycle = 90 mins w/6 trains in service.

Page 6

Table 3-B

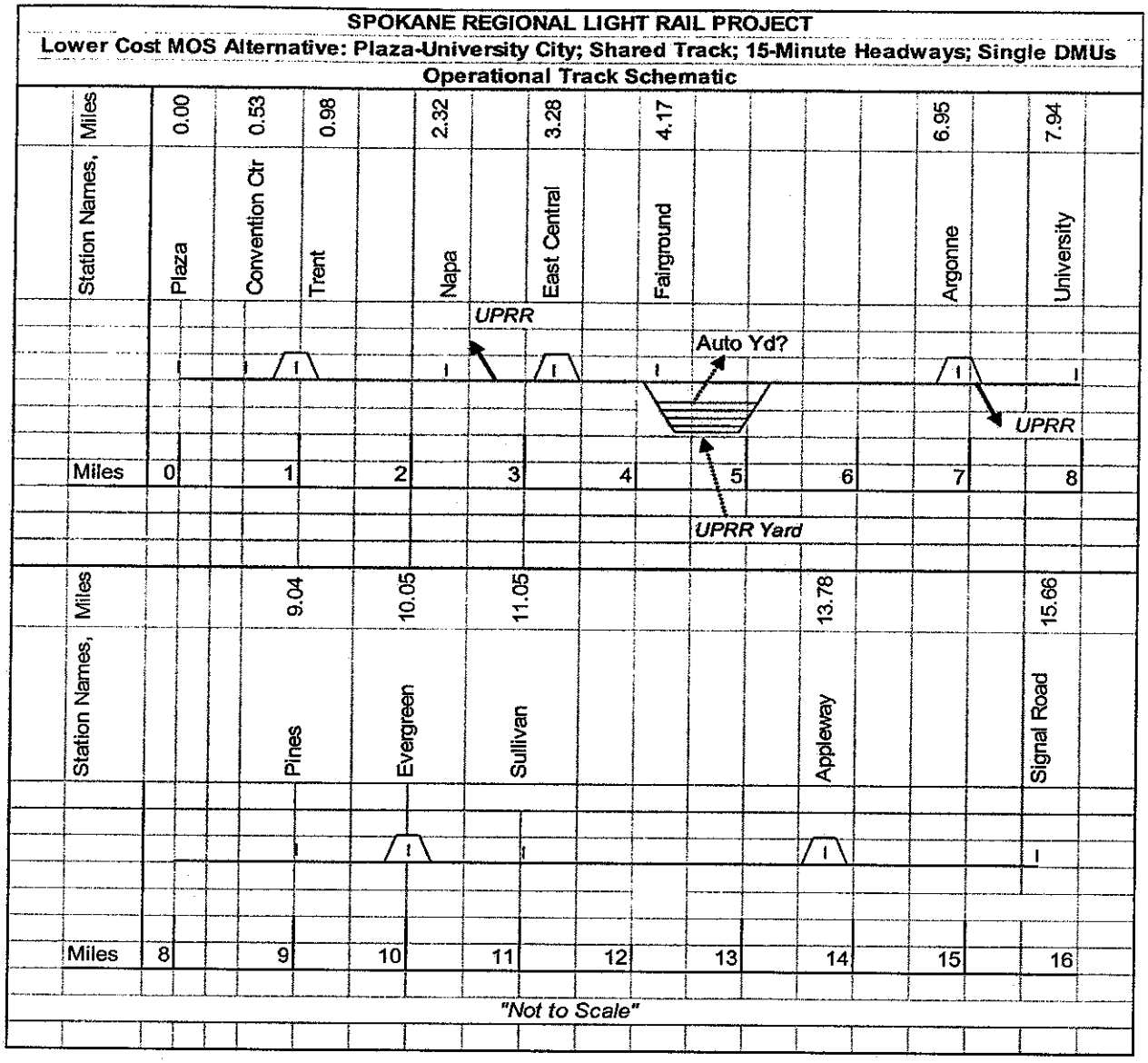
SPOKANE REGIONAL LIGHT RAIL PROJECT
"Single-Track Option" : DMU Shared Track, Plaza to Liberty Lake; 15-Minute Headways
Timetable Fragment Showing Meets; 90-Minute Cycle, 6 Trains, 5 Meets/Run, 37-Minute 1-Way Run
Departures on Quarter Hour from West End of Line and One Minute Past Quarter Hour from East End of Line

Outbound (Read Down)							Stations		Inbound (Read Up)					
A1	*B2*	*C2*	*D2*	*E2*	*F2*		*Trainset/Run#*		*B1*	*C1*	*D1*	*E1*	*F1*	*A2*
10:00:00	10:15:00	10:30:00	10:45:00	11:00:00	11:15:00	lv	Plaza	ar	10:08:00	10:23:00	10:38:00	10:53:00	11:08:00	11:23:00
10:01:30	10:16:30	10:31:30	10:46:30	11:01:30	11:16:30	ar	Convention Ctr	lv	10:06:30	10:21:30	10:36:30	10:51:30	11:06:30	11:21:30
10:02:00	10:17:00	10:32:00	10:47:00	11:02:00	11:17:00	lv	"	ar	10:06:00	10:21:00	10:36:00	10:51:00	11:06:00	11:21:00
10:03:30	10:18:30	10:33:30	10:48:30	11:03:30	11:18:30	ar	Trent	lv	10:04:30	10:19:30	10:34:30	10:49:30	11:04:30	11:19:30
10:04:00	**10:19:00**	**10:34:00**	**10:49:00**	**11:04:00**	**11:19:00**	lv	"	ar	**10:04:00**	**10:19:00**	**10:34:00**	**10:49:00**	**11:04:00**	**11:19:00**
10:08:00	10:23:00	10:38:00	10:53:00	11:08:00	11:23:00	ar	Napa	lv	10:00:00	10:15:00	10:30:00	10:45:00	11:00:00	11:15:00
10:08:30	10:23:30	10:38:30	10:53:30	11:08:30	11:23:30	lv	"	ar	9:59:30	10:14:30	10:29:30	10:44:30	10:59:30	11:14:30
10:11:30	**10:26:30**	**10:41:30**	**10:56:30**	**11:11:30**	**11:26:30**	ar	East Central	lv	**9:56:30**	**10:11:30**	**10:26:30**	**10:41:30**	**10:56:30**	**11:11:30**
10:12:00	10:27:00	10:42:00	10:57:00	11:12:00	11:27:00	lv	"	ar	9:56:00	10:11:00	10:26:00	10:41:00	10:56:00	11:11:00
10:13:30	10:28:30	10:43:30	10:58:30	11:13:30	11:28:30	ar	Fairground	lv	9:54:30	10:09:30	10:24:30	10:39:30	10:54:30	11:09:30
10:14:00	10:29:00	10:44:00	10:59:00	11:14:00	11:29:00	lv	"	ar	9:54:00	10:09:00	10:24:00	10:39:00	10:54:00	11:09:00
10:19:00	**10:34:00**	**10:49:00**	**11:04:00**	**11:19:00**	**11:34:00**	ar	Argonne	lv	**9:49:00**	**10:04:00**	**10:19:00**	**10:34:00**	**10:49:00**	**11:04:00**
10:19:30	10:34:30	10:49:30	11:04:30	11:19:30	11:34:30	lv	"	ar	9:48:30	10:03:30	10:18:30	10:33:30	10:48:30	11:03:30
10:21:30	10:36:30	10:51:30	11:06:30	11:21:30	11:36:30	ar	University	lv	9:46:30	10:01:30	10:16:30	10:31:30	10:46:30	11:01:30
10:22:00	10:37:00	10:52:00	11:07:00	11:22:00	11:37:00	lv	"	ar	9:46:00	10:01:00	10:16:00	10:31:00	10:46:00	11:01:00
10:24:00	10:39:00	10:54:00	11:09:00	11:24:00	11:39:00	ar	Pines	lv	9:44:00	9:59:00	10:14:00	10:29:00	10:44:00	10:59:00
10:24:30	10:39:30	10:54:30	11:09:30	11:24:30	11:39:30	lv	"	ar	9:43:30	9:58:30	10:13:30	10:28:30	10:43:30	10:58:30
10:26:30	**10:41:30**	**10:56:30**	**11:11:30**	**11:26:30**	**11:41:30**	ar	Evergreen	lv	**9:41:30**	**9:56:30**	**10:11:30**	**10:26:30**	**10:41:30**	**10:56:30**
10:27:00	10:42:00	10:57:00	11:12:00	11:27:00	11:42:00	lv	"	ar	9:41:00	9:56:00	10:11:00	10:26:00	10:41:00	10:56:00
10:29:00	10:44:00	10:59:00	11:14:00	11:29:00	11:44:00	ar	Sullivan	lv	9:39:00	9:54:00	10:09:00	10:24:00	10:39:00	10:54:00
10:29:30	10:44:30	10:59:30	11:14:30	11:29:30	11:44:30	lv	"	ar	9:38:30	9:53:30	10:08:30	10:23:30	10:38:30	10:53:30
10:33:30	10:48:30	11:03:30	11:18:30	11:33:30	11:48:30	ar	Appleway	lv	9:34:30	9:49:30	10:04:30	10:19:30	10:34:30	10:49:30
10:34:00	**10:49:00**	**11:04:00**	**11:19:00**	**11:34:00**	**11:49:00**	lv	"	ar	**9:34:00**	**9:49:00**	**10:04:00**	**10:19:00**	**10:34:00**	**10:49:00**
10:37:00	10:52:00	11:07:00	11:22:00	11:37:00	11:52:00	ar	Signal Rd	lv	9:31:00	9:46:00	10:01:00	10:16:00	10:31:00	10:46:00

Note: Meet locations in **bold**. Terminal layovers: Plaza 7.0 mins; Signal Rd 8.5 mins. Operating Cycle = 90 mins w/6 trains in service.

Page 7

Figure 1


SPOKANE REGIONAL LIGHT RAIL PROJECT
Lower Cost MOS Alternative: Plaza-University City; Shared Track; 15-Minute Headways; Single DMUs
Operational Track Schematic
Miles
Station Names,
0.00
Plaza
0.53
Convention Ctr
0.98
Trent
2.32
Napa
3.28
East Central
4.17
Fairground
6.95
Argonne
7.94
University
UPRR
Auto Yd?
UPRR
Miles
0
1
2
3
4
5
6
7
8
UPRR Yard
Miles
Station Names,
9.04
Pines
10.05
Evergreen
11.05
Sullivan
13.78
Appleway
15.66
Signal Road
Miles
8
9
10
11
12
13
14
15
16
"Not to Scale"

1.4 Operating Statistics

For the Single-Track Option, all peak and most base service is provided at the "policy" headway of 15 minutes between trains, the longest interval desirable to attract strong ridership during the primary daytime riding hours, yet with sufficient carrying capacity to accommodate expected initial levels of riding. Headways of 30 minutes are contemplated for early morning and late evening service, Monday through Saturday, and all day service on Sunday and holidays. This scenario is summarized in Table 4.

Table 4

Summary of Service Headways by Day and Time of Day

Time Period	Headway	Weekdays	Weekends/Holidays
AM & PM Peak Hours	15 minutes	07:00-09:00 + 16:00-18:00	—
Base Service	15 minutes	09:00-16:00 + 18:00-20:00	07:00-20:00 (Sat. only)
Early/Late Service	30 minutes	05:00-07:00 + 20:00-23:00	05:00-07:00 + 20:00-23:00 (Sat.) 05:00-23:00 (Sun. & Hol.)

Operating statistics for this alternative have been computed, and are shown in Table 5. The service would generate 26,591 annual revenue train hours, and 666,270 annual train miles. Since all trains would be operated with a single DMU, vehicle miles are the same as train miles.

1.5 Estimated Operating & Maintenance Costs

Operating and maintenance costs for this option are estimated to be approximately $5.6 million per year, as calculated in Table 6. The cost model uses a unit rate for each major cost category based on:

- Transportation: Revenue Vehicle Hours
- Vehicle Maintenance: Number of vehicles
- Non-Vehicle maintenance: Track Miles
- General & Administrative: 40% of the sum of the previous three categories
- Contingency: 20% of the above, appropriate for a project in Preliminary Engineering

Since no new structures are included in this alternative, there is no estimate for the cost category, Maintenance of New Structures.

1.6 Operations and Maintenance Facility

The conceptual O & M facility floor plan developed in September of 2003 and submitted with the draft alignment plan in January 2004 has sufficient capacity to be used for the eight-car fleet. Additional yard track will be needed to bring the yard DMU storage capacity to six vehicles (considers 2 vehicles stored in the shop). The cost estimate for this alternative should be based on the 20,400 square foot building discussed above and approximately 720 track feet for the storage yard (120 feet per DMU).

Table 5

SPOKANE REGIONAL LIGHT RAIL PROJECT
Extended MOS Alternative; DMU Shared Track, Plaza to Liberty Lake
Preliminary Estimates of Annual Revenue Train Hours, Train Miles, and Vehicle Miles

Assumptions

- Operates 18 hours a day, 5:00 AM to 11:00 PM
- One-Car Trains on all trips.
- Train Headways as shown on table.

Analysis

Schedule of Operations		Train Headway			Number of Trains						Total Trains per Week		
					M - F		Sat		Sun				
		M-F	Sat	Sun	In	Out	In	Out	In	Out	M-F	Sat	Sun
5:00	7:00	30	30	30	4	4	4	4	4	4	40	8	8
7:00	9:00	15	15	30	8	8	8	8	4	4	80	16	8
9:00	16:00	15	15	30	28	28	28	28	14	14	280	56	28
16:00	18:00	15	15	30	8	8	8	8	4	4	80	16	8
18:00	20:00	15	15	30	8	8	8	8	4	4	80	16	8
20:00	23:00	30	30	30	6	6	6	6	6	6	60	12	12
					Total One-Way trips (= Trains)						620	124	72
					Total One-Way Trips per Week (= Trains)								816
					Total One-Way trips per Year (= Trains)								42546
					Total Revenue Train Hours per Year (37.5 minutes per trip)								26591
					Total Revenue Train Miles per Year (15.66 miles per trip)								666270

Table 6

SPOKANE REGIONAL LIGHT RAIL PROJECT
"Single-Track Option" ; DMU Shared Track, Plaza to Liberty Lake
Plaza-Liberty lake; 15-Minute Headways; Single DMUs
Estimated O&M Costs

Item	Basis	Unit $	No. Units	Est O&M/Yr (millions)	%
Transportation	Rev Veh Hrs	$51.34	26591	$1.37	29%
Vehicle maintenance	Vehicles	$84,800	8	$0.68	15%
Non-Vehicle Maintenance	Track Miles	$75,600	17	$1.29	28%
Maintenances of New Structures	Each	$25,000	0	$0.00	0%
Genl & Administrative	40% Above	40%	--	$1.34	29%
Subtotal				$4.68	100%
Estimating Contingency	20% Above	20%	--	$0.94	50%
Total Estimated O&M [a]				$5.62	--
[a] Total O&M converts to $211.35 per Train Hour or $8.44 per Vehicle Mile.					

2. Capital Cost Estimate

2.1 Methodology

The methodology used for this estimate has been developed for the conceptual engineering effort for the Spokane Regional Light Rail Project and used to develop a cost estimate associated with 10% level conceptual design. The conceptual cost estimate was prepared in three steps. In the first step, the defined project alignment was broken down into logical geographical limits or line segments for estimating purposes. While no new conceptual engineering has yet been undertaken for this option, the conceptual engineering drawings from the previously developed "Shared-Track Alternative" were found to be most applicable to the line segment east of University City. They were "red-lined" to note specific assumptions and guidance for the cost estimator and were used to define the nature of work and facilitate a "take-off" or measurement of the work to establish quantities. Conceptual engineering drawings for the MOS Alternative were used for the segment west of University City. Where defined the actual quantities were measured and used, including for example linear feet of track, numbers of parking spaces etc. Units of measure are the US Standard as appropriate (i.e. CY for Cubic Yard, FT for Feet, LS for Lump Sum etc.). Where insufficient detail currently exists to estimate quantities with certainty, reference to previous conceptual designs or cross-sections was made as the basis for the estimation of quantities.

The second step was the selective application of initial cost data to the quantities established in step one and to develop unit cost and lump sum cost items in current year dollars. In this estimate 60 to 65 individual cost items were used. These items have been organized into a "Bid Item Tabulation" format which can been seen in the Appendix.

The third step is to consolidate or gather these items into the 17 major project cost elements as defined below. Engineering and administration cost allocations as well as project contingencies are added on in this phase of the estimate. If a special contingency is required for any element, it was calculated in this category (i.e. a contingency of 50% has been applied to Utilities). The capital costs have been estimated in current year 2004 US dollars. Sub-totals have been inflated at 4.0% per year to get to the currently assumed midpoint of construction year, 2008. An allowance for the contractor's margins (profit, overhead etc.) and insurance was incorporated into the unit prices used to prepare the cost estimates.

The seventeen major project cost elements used to assemble the cost estimate are listed below:

1. Civil Construction
2. Insurance (Included in Civil Construction and Right-of-Way)
3. Utilities
4. Track Materials Procurement (Included in Civil Construction)
5. Structures
6. Stations
7. Park & Rides
8. Operations Facility
9. Traction Electrification System

10. Signal System
11. Communications
12. Fare Collection
13. Right-of-Way
14. Vehicles
15. Engineering & Administration
16. Contingency
17. Washington State Sales Tax

As noted, items 2 and 4 are incorporated into other cost elements at this stage of estimating. For a description of each of these cost elements, refer to the report, "Conceptual Design Cost Estimates Report, Two New "Low Cost" Alternatives: U-City Light Rail Minimum Operable Segment (MOS), Bus RapidTransit Alternative (BRT)" prepared by the GMEC and dated, April 2004.

2.2 Assumptions

Similar to the MOS Rail Alternative, the Single-Track Option is intended to be a low-cost start up rail system that can be upgraded and expanded in the future. The design of the westerly segment is based on the Conceptual Design Drawings for the MOS submitted in January 2004 and the Conceptual Design Report submitted in February 2004. No conceptual design of the easterly segment has yet been performed. The philosophy used in the development of this option was to keep the costs as low as possible. The design is targeted to achieve costs comparable to streetcar systems.

Significant Characteristics Include:

- Single-track with short passing tracks
- Use of diesel light rail vehicles also referred to as DMUs
- Short, simple stations that accommodate single unit operations ("single-car trains")
- Maximize the use of existing UPRR tracks
- Minimize reconstruction of UPRR tracks but provide sufficient improvements necessary to assure safe passenger operations
- Generally utilize at-grade operations with no newly constructed bridges for the project. Use existing bridges for grade separation of crossings where available.
- Minimum right-of-way acquisition by using existing public rights-of-way to the extent available.
- Relocation of only the utilities that are directly impacted by construction
- Private utilities in publicly owned rights-of-way anticipated to be relocated by the utility owner
- Impacted roadways will only be re-paved in the area of the tracks, not curb to curb
- No improvements to adjacent right-of-way
- No corridor landscaping (a landscape allowance has been provided at station locations)
- Availability of STA's Fleck Service Center for renovation and use as the Light Rail Operations and Maintenance facility:
- Downtown terminus location on Riverside Avenue

The preferred alternative decision may select a more expensive version of the base options. For example the final decision might be to electrify the system instead of using diesel powered vehicles. Or the decision might be to provide more passing tracks to reduce headways and enable the project to provide more frequent service with more vehicles, thereby providing a higher passenger capacity. Of course, with each enhancement would come a corresponding higher cost.

2.3 Cost Estimate Summary

The "base price" for the Single Track Option is summarized in the table below, and includes capital costs for the light rail components. No bus service improvements are included. Details of the estimate are provided in the appendix.

Table 7
SPOKANE REGIONAL LIGHT RAIL PROJECT
"Single-Track Option" ; DMU Shared Track, Plaza to Liberty Lake
Plaza-Liberty lake; 15-Minute Headways; Single DMUs
Capital Costs

Project Component	Amount ($ Millions)
Civil Construction	36.9
Utilities	12.4
Structures	0.4
Stations	2.5
Park & Rides	2.8
Operations/Maintenance Facility	3.1
Traction Power System	N/A
Signal System	19.0
Communications	2.1
Fare Collection	0.9
Right of Way	20.9
Vehicles	33.2
Engineering & Administration	29.7
Contingencies	20.9
WA State Sales Tax	8.8
Escalation	32.9
TOTAL (Millions - 2008 $)	226.5

A comparison of the estimated cost of the Single-Track Option with the capital costs previously estimated for the project alternatives considered in the DEIS is provided in the following table. On a per-mile basis, the cost of this option is less expensive than any of the other rail alternatives estimated to date, and is at the very low end of industry standards for new light rail projects being constructed in the United States. It is, however, similar in per-mile costs experienced in recent streetcar projects. It is again noted that this option has not yet been subjected to a conceptual engineering effort and it is possible that costs could increase, given the more complete information that such an effort would provide.

Table 8
SPOKANE REGIONAL LIGHT RAIL PROJECT
Comparison of Estimated Capital Costs for "Single-Track Option" to Previously Estimated Project Alternatives

Alternative and / or Option	Total Cost (Millions of Year 2008 $)
Separate Track Alternative – Double-Track Electric to Liberty Lake	658
Shared Track Alternative – Single-Track Diesel to Liberty Lake	408
U-City LRT Alternative – Single-Track LRT to U-City	134
BRT to Liberty Lake	26
Total for this Alternative	160
BRT Alternative – Sprague / Riverside Option	62
BRT Alternative – Trent Option	67
"Single-Option" – Described in this Report	227