19.0 CAPITAL & OPERATING COSTS

19.1 Capital Costs

Construction costs are one-time capital expenditures. The capital cost for the proposed City of Miami Streetcar system was developed based on the constructed Portland Streetcar project and was refined for local conditions, as identified through numerous field visits. Because of the large number of unknown factors at this point in project development, such as utility locations and street reconstruction, several assumptions had to be made to develop the construction cost estimate presented in **Table 19.1.1**. This construction cost estimate includes the cost of preliminary engineering, final design, vehicle procurement, and program management as well as a 30 percent contingency. The contingency was added to the single- and double-track cost-per-mile estimates and the maintenance and operations facility (MOF) as well as the required at-grade Florida East Coast (FEC) Railway crossings. The estimated capital cost of the proposed system is approximately $132.2 million in 2004 dollars, which is approximately $19.6 million per route mile including the proposed MOF.

19.1.1 Assumptions

It was assumed that the capital cost estimate is for the City of Miami Streetcar system only, with the exception that the MOF site is sized large enough to accommodate the Bay Link system in the future. The following lists some of the other assumptions made to arrive at the preliminary construction cost estimates. Items unknown at this feasibility phase were accounted for in contingency.

General Assumptions

- Eight Portland-type vehicles (Inekon–Skoda Astra), 750 volts DC
- Track slab design with girder rail and embedded turnouts
- Basic station stop configuration with custom-designed shelters and amenities
- A 141-lb RE rail and full signalization for the crossings of the FEC Railway branch line and Port of Miami switching lead

Track Work

- Track slab 8 ft 2 in. wide by 12 in. thick with a 1 percent cross slope
- Minimum soil support pressure 3,000 pounds per square foot (psf)
- Double flexieve tongue turnouts with spring actuated throw mechanisms and guarded frogs
- Rubber rail boot to protect against stray current
- Turnout tubs and spray on insulation material to protect against stray current in the turnouts
- Custom-designed rigid crossings for intersecting streetcar lines

Roadway/Civil

- Roadway milling and resurfacing throughout to meet the new track slab cross slope and to facilitate proper storm drainage
- Excavation and compaction to a depth of 14 to 18 in. by 10 ft wide, depending on the roadway profile, to install the track slab
- Re-striping and addition of new signing
- Curb replacement and installation for on-street parking

Utilities

- Relocation of all underground parallel water, sanitary sewer, storm, gas, and telephone lines that are under the proposed track slab
- Relocation of or increase in the height of all overhead lines (telephone, electric, and cable television) that are less than 26 ft above the top of the rail
- Lowering, or encasing, and provision of cathodic protection for all underground utilities that are less than 24 in. below the bottom of the track slab

Traction Power

- Pole spacing approximately 80 ft apart
- Steel, tapered poles
- For double-track segments, poles on both sides of the street or attachment to adjacent buildings with span wires to support the traction power wires
- For single-track segments, one pole or attachment to the Metromover supports as appropriate
- Small 350 kW substations spaced approximately 0.5 mile apart to provide traction power

Maintenance Facility

- A 7- to 10-acre parcel to accommodate both the Miami Streetcar system and the Bay Link system
- A facility to service and store the eight City vehicles plus the Bay Link vehicles
- A location within 0.75 mile of the mainline

Table 19.1.1
Construction Cost Estimate (2004)

Track, Roadway and Utility Unit Costs				
Single Track Items				
Traffic Control and Mobilization (10%)	$ 690,000			
Roadway	$ 1,810,000			
Stations (Platform and Shelter)(6 per mile)	$ 390,000			
Utilities	$ 900,000			
Track & Traction Power	$ 3,800,000			
Subtotal Single Track Cost	**$ 7,590,000**	**Per Mile**		
Subtotal Double Track Cost *	**$ 12,700,000**	**Per Mile**		
Track, Roadway and Utility Costs	Feet	Miles	Cost per Mile	Cost
Single Track	16,700	3.16	$ 7,590,000	$ 23,990,000
Double Track	9,471	1.79	$ 12,700,000	$ 22,790,000
Subtotal Track, Roadway and Utility Costs				**$ 46,780,000**
Maintenance Facility				
Property Acquisition				$ 5,000,000
Facility				$ 9,000,000
0.75 miles Double Track				$ 9,525,000
Railroad Crossings - (2@$1.25 Million each)				$ 2,500,000
Subtotal Maintenance Facility				**$ 26,025,000**
FEC Rail Crossings (4 @ $1.25 Million each)				**$ 5,000,000**
Subtotal Construction Costs				**$ 77,805,000**
Contingency (30%)				$ 23,350,000
Vehicles (8 at $2.33 Million each)				$ 18,640,000
Total Construction Costs				**$ 119,795,000**
Design / Construction Management Costs				
Preliminary, Final Design and Vehicle Procurement@ 12% **				$ 9,340,000
Construction Management @ 4% **				$ 3,120,000
Total Design/CM Costs				**$ 12,460,000**
TOTAL PROJECT COST				**$ 132,255,000**

* Double Track per mile cost estimated to be 2/3 higher than Single Track due to construction overlap/redundancy.
** Vehicle and Contingency not included in percent calculation. Assumes Design Build procurement

FEC Crossings

- At-grade rail-to-rail crossings utilizing concrete embedded track work
- Installation of a remote interlocking signal system to meet Federal Railroad Administration (FRA) requirements and an upgraded crossing protection system
- Isolation of the FEC Railway track from stray current
- Design of new systems included in streetcar design costs

19.1.2 Bay Link Share

Through coordination with the Bay Link project, it is understood that the Bay Link system will share facilities with the Miami Streetcar system. Some basic assumptions were made regarding the shared costs related to the Bay Link project, including a 50 percent share rate for the estimated cost of these facilities as well as the same contingency and design percentages.

To estimate the share cost, preliminary assessments of track sharing were made for both single- and double-track sections assuming the following shared track sections :

Shared Single Track

- NE 9th Street from NE 2nd Avenue to Miami Avenue
- Miami Avenue from NE 9th Street to NW 3rd Street
- NW 3rd Street from Miami Avenue to NW 1st Avenue
- NW 1st Avenue from NW 3rd Street to SW 1st Street
- SW 1st Street from NW 1st Avenue to Miami Avenue
- SE 1st Street from Miami Avenue to SE 1st Avenue
- NE 1st Avenue from NW 3rd Street to NE 14th Street
- NE 14th Street from NE 1st Avenue to NE 2nd Avenue
- NE 2nd Avenue from NE 14th Street to NE 9th Street

Shared Double Track

- NE 2nd Avenue from NE 17th Street to NE 14th Street

A portion of the track listed above is necessary to reach the proposed MOF. **Table19.1.2** indicates the cost of these shared facilities as $72.4 million. Applying the assumed 50 percent share rate, the total cost assumed to be the responsibility of the Bay Link project is $36.2 million.

19.2 Operating Costs

19.2.1 Operating Plan

A sketch streetcar operating plan was developed for purposes of generating operating and maintenance (O&M) costs and vehicle fleet requirements and as an input for the ridership model. **Tables 19.2.1** and **19.2.2** provide distances and run times for northbound and southbound operations. As shown, the estimated end-to-end run times are approximately 24 and 23 minutes, respectively.

Table 19.1.2
Bay Link's Share-Cost Estimate (2004)

	Feet	Miles	Cost Per Mile	Cost
Shared Single Track	12,800	2.42	$ 7,590,000	$ 18,400,000
Shared Double Track *	1,100	0.21	$ 12,700,000	$ 2,650,000
Railroad Crossings				
2 at $1.25 Million Each				$ 2,500,000
Maintenance Facility				$ 26,025,000
Subtotal Construction Costs				**$ 49,575,000**
Contingency (30%)				$ 14,880,000
Total Construction Costs				**$ 64,455,000**
Design / Construction Management Costs				
Preliminary, Final Design and Vehicle Procurement@ 12% **				$ 5,950,000
Construction Management @ 4% **				$ 1,990,000
Total Design/Construction Management Costs				**$ 7,940,000**
Total Cost of Items to be Shared				$ 72,395,000
BAY LINK SHARE (50%)				**$ 36,198,000**
Bay Link Share of Total Project Cost				**27.37%**
Notes:				
Shared Single Track Calculation:				
NE 9th Street to Miami Ave, to NW 3rd St, to NW 1St Ave, to SW 1st Street to SE 1st Avenue = 6,100 feet				
NE 1st Avenue from NE 3rd Street to 14th Street and 14th Street to NE 2nd Avenue = 4,700 feet				
NE 2nd Avenue from NE 14th Street to NE 9th Street = 2,000 feet				
Total Single Track = 12,800 feet				
Shared Double Track Calculation:				
NE 2nd Avenue from NE 17th Street to NE 14th Street = 1,100 feet				
Total Double Track = 1,100 feet				

* Double Track per mile cost estimated to be 2/3 higher than Single Track due to construction overlap/redundancy.
** Vehicle and Contingency not included in percent calculation. Assumes Design Build procurement.

The run time and distance information in **Tables 19.2.1 and 19.2.2** was also used to estimate vehicle fleet requirements. The current recommended plan is to provide peak and off-peak service at 10 minute headways along the entire route. In addition, a 20 percent fleet adjustment should be made for in-service vehicles or a minimum of two additional cars, whichever is greater, to calculate the total fleet requirements. Therefore, based on the in-service vehicle estimates in **Table 19.2.3,** the estimated minimum fleet should be eight vehicles for the initial system running from Government Center to the Miami Design District and Buena Vista East Historic District.

19.2.2 Costs

Unlike one-time capital expenditures, annual O&M costs must be estimated to determine the actual cost of the proposed system. The Portland Streetcar was used as the basis for the annual O&M costs and adjusted for use in the Miami project in 2004 dollars. The Portland Streetcar revenue service hour costs were assembled from 2001 to 2003. To evaluate costs within the City of Miami, bus O&M costs were compared and an adjustment factor was created to account for the differences in the two cities. The number of required vehicles to provide service along the proposed alignment was estimated assuming a 10-minute headway. Then the number of revenue service hours was calculated assuming a 16-hour-per-day operating scenario, Monday through Saturday, and 12 hours on Sunday. In addition to the basic costs for service, the project would have some unique costs to cross the FEC Railway multiple times. **Table 19.2.4** summarizes the O&M costs, which total $3.5 million annually in 2004 dollars.

Table 19.2.1
Northbound Train Distances and Run Times

Running Along	Car Stop	Feet	Miles	Mile Post	Estimated Minutes	Schedule Minutes
SW 1st St.	NW 1st Ave.	--	--	0.00	--	--
SW 1st St.	NE 1st Ave.	990	0.19	0.19	1.1	1.5
NE 2nd Ave.	NW 1st. St.	675	0.13	0.32	0.8	1.0
NE 1st Ave	NW 4th St	1160	0.22	0.54	1.3	1.5
NE 1st Ave	NW 6th St.	710	0.13	0.67	0.8	1.0
NE 1st Ave	NW 8th St.	780	0.15	0.82	0.9	1.0
NE 1st Ave	NW 11th St.	1150	0.22	1.04	1.3	1.5
NE 1st Ave	NW 14th St.	1350	0.26	1.29	1.5	1.5
NE 2nd Ave.	NE 17th St.	1900	0.36	1.65	2.2	2.5
NE 2nd Ave.	NE 19th St.	890	0.17	1.82	1.0	1.0
NE 2nd Ave.	NE 23rd St.	1600	0.30	2.12	1.8	2.0
NE 2nd Ave.	NE 26th St.	930	0.18	2.30	1.1	1.5
NE 2nd Ave.	NE 29th St.	860	0.16	2.46	1.0	1.0
Midtown	NE 30th St.	1280	0.24	2.70	1.5	1.5
Midtown	NE 32nd St.	750	0.14	2.85	0.9	1.0
NE 2nd Ave.	NE 36th St.	1300	0.25	3.09	1.5	2.0
NE 2nd Ave.	NE 39th St.	770	0.15	3.24	0.9	1.0
NE 2nd Ave.	NW 40th St.	830	0.16	3.39	0.9	1.0
	Total Line North	17,925	3.39		20.4	23.5

Table 19.2.2
Southbound Train Distances and Run Times

Running Along	Car Stop	Feet	Miles	Mile Post	Estimated Minutes	Schedule Minutes
NE 2nd Ave.	NW 40th St.	--	--	0	--	--
NE 1st Ave	NW 39th St.	900	0.17	0.17	1.0	1.0
NE 1st Ave	NW 36th St.	800	0.15	0.32	0.9	1.0
Midtown	NW 32nd St.	1300	0.25	0.57	1.5	1.5
Midtown	NW 30th St.	730	0.14	0.71	0.8	1.0
NE 2nd Ave.	NW 29th St.	1220	0.23	0.94	1.4	1.5
NE 2nd Ave.	NE 26th St.	880	0.17	1.10	1.0	1.0
NE 2nd Ave.	NE 23rd St.	960	0.18	1.29	1.1	1.5
NE 2nd Ave.	NE 19th St.	1520	0.29	1.57	1.7	2.0
NE 2nd Ave.	NE 17th St.	910	0.17	1.75	1.0	1.0
NE 2nd Ave.	NE 14th St.	1630	0.31	2.05	1.9	2.0
NE 2nd Ave.	NE 11th St.	1050	0.20	2.25	1.2	1.5
N. Miami Ave.	NW 8th St.	2100	0.40	2.65	2.4	2.5
N. Miami Ave.	NW 6th St.	720	0.14	2.79	0.8	1.0
N. Miami Ave.	NW 4th St.	720	0.14	2.92	0.8	1.0
NW 1st Ave.	NW 3rd St.	800	0.15	3.08	0.9	1.0
NW 1st Ave.	NW 1st St.	710	0.13	3.21	0.8	1.0
NW 1st Ave.	SW 1st. St.	855	0.16	3.37	1.0	1.0
	Total line South	17,805	3.37		20.2	22.5

Table 19.2.3
Estimates of In-Service Cars Varying with Line Lengths and Service Frequency (Headway)

From	To	Estimated Miles Link	Estimated Miles Cume	Estimated Minutes Link	Estimated Minutes Cume	Round Trip	Complete Cycle	Cars Given Service Headways 5 Mins	7.5 Mins	10 Mins
From Government Center										
Flagler at SW 2nd Av	NE 4th	0.7	0.7	5.0	5.0	10	15	3	2	2
	NE 17th St	1.0	1.7	6.5	11.5	23	30	6	4	3
	NE 36th	1.3	3.0	9.0	20.5	41	45	9	6	5
	NE 40th	0.2	3.2	1.0	21.5	43	50	10	7	6

Table 19.2.4
Annual Operating & Maintenance Cost Estimate

Portland Streetcar Inc. Revenue Service Hour (RSH) Costs

		Year	Cost	Notes
Existing RSH		2001	$ 115.17	
Existing RSH		2003	$ 122.00	
Average Annual Inflation Estimate	3.0%			
Estimated RSH		**2004**	**$ 125.66**	

Portland/Miami Adjustment Based on Bus O&M Costs per RVH

		Year	Cost per RVH	Notes
Miami (Miami Dade Transit)		2002	$ 78.55	Based on National Transit Database
Portland (TriMet)		2002	$ 90.48	
Adjustment Factor	**87.0%**			

Estimated Miami Streetcar Cost per RVH

	Year	Cost per RVH	Notes
	2004	$ 109.32	
Estimated Rounded Miami Cost per RVH		**$ 110.00**	

Estimated Miami Streetcar RVH

		Annual RVH	Notes
Number of Vehciles	5		10 Minute Headways
Monday to Saturday Service		4,992	16 Hours per day
Sunday Service		624	12 Hours per Day
Total RVH per Vehicle		5,616	
Total System RVH		**28,080**	

Operating and Maintenance Costs

O&M using RVH		$ 3,100,000
Miscellaneous O&M Costs		$ 400,000
TOTAL O&M COSTS		**$ 3,500,000**