



**DRAFT**

**Fort Worth Modern Streetcar**

**PLANNING COST ESTIMATE**

**AUGUST 25, 2010**

**1.0 Introduction**

The City of Fort Worth has hired HDR to assist in advancing the modern streetcar project into early alignment selection and evaluation and in identification of technical aspects and issues. This memo, along with its attachment, is meant to satisfy the need for an order-of-magnitude Planning Cost Estimate to draw capital cost comparisons between the six modern streetcar alignment alternatives.

**2.0 Methodology for Construction Costs**

The route alignment options were conceptually designed using aerial mapping and input from the project team, following the design criteria provided in Technical Memorandum No. 1 – Design Assumptions as closely as possible. Areas were noted where the design criteria could not be met due to existing conflicts along the route, and the mitigation of those areas has been accounted for in this cost analysis.

The approach taken to estimate capital costs for the alignments, at this early level of analysis, was to take a similar streetcar project’s cost and compute a per-mile cost for each item. For the purposes of this analysis, the similar streetcar project chosen was the system in Tucson, Arizona, currently nearing the end of final design. The Tucson system was chosen because it contains similar alignment characteristics, street configurations, and neighborhood districts as the Fort Worth alignments. The Tucson engineer’s itemized estimate was rolled up into major categories and then divided by the total mileage. The categories are based on the Federal Transit Administration (FTA)’s Standard Cost Categories (SCC) for major capital projects. The summary of the Tucson base costs are as follows:

10	GUIDEWAY & TRACK ELEMENTS	\$	26,554
20	STATIONS, STOPS, TERMINALS, INTERMODAL	\$	3,060
40	SITWORK & UTILITIES	\$	16,275
50	SYSTEMS	\$	12,132

*Note – costs shown in thousands*

A contingency was applied to each individual category, called an allocated contingency. The allocated contingency of each item can be adjusted during later phases of engineering to account for the level of certainty and risk of each item. At this stage of planning, an allocated



contingency of 20% was assigned to each item. This is shown in the column of the attached cost estimate.

Inflation of the base year costs is estimated at 5% total (not per year) to the year of construction. Actual inflation rates vary from year to year and will be estimated on a per-year basis during later stages of project development.

These items were totaled and then divided by Tucson’s total route miles (3.55 miles) to get a base cost of \$20,593,000 per route mile.

10	GUIDEWAY & TRACK ELEMENTS	\$	33,458
20	STATIONS, STOPS, TERMINALS, INTERMODAL	\$	3,856
40	SITWORK & UTILITIES	\$	20,507
50	SYSTEMS	\$	15,286
	<b>SUBTOTAL (10, 20, 40, 50) (TUCSON)</b>	<b>\$</b>	<b>73,106</b>
	ROUTE MILES (TUCSON)		3.55
	<b>COST /ROUTE MILE (10,20,40,50)</b>	<b>\$</b>	<b>20,593</b>

*Note – costs shown in thousands*

For the Fort Worth alignments, this base cost/route mile is multiplied by each alignment’s route miles to achieve a base construction cost for each alignment. Each alignment’s mileage was estimated from end to end.

It is important to note that this estimate’s per-mile cost for track is for a twin-track alignment, known as a “route mile”. Variations from a twin-track configuration, such as one-way track pairs (known as “couplets”) and end-of-line loops typically cost slightly more than twin-track alignments due to extra poles, traffic signals, etc. For the purposes of this planning-level estimate, the cost per route mile derived from the Tucson system, plus the contingency, accounts for these variations. Future cost estimates, developed with greater detail, will quantify the twin-track and single-track configurations separately.

The engineering team reviewed each route alignment for major engineering items unique to each alignment which were not already accounted for in the base construction cost. Major engineering items such as bridges, underpasses/overpasses, railroad crossings, and existing buildings and facilities were all considered for their complexity and uncertainty. These items and their individual costs are listed separately in the attached estimate and are provided below. Each item listed below already includes an allocated contingency and inflation factor within the unit cost. The costs are included in the construction subtotal for each alternative.

Unique cost items for Downtown - West 7th include:

- Temporary shoe-fly for railroad crossing installation in 7th Street; cost \$1M
- Fully upgraded signal at railroad crossing in 7th Street to current standards to allow railroad crossing at-grade; cost \$250K



- It is assumed that the upgrades to the West 7<sup>th</sup> Bridge to accommodate the loading of streetcars and the installation of a trough for a future trackway are being done by another project.

Unique cost items for Downtown - North Main include:

- Upgrades to existing Paddock Viaduct; cost \$0.5M

There were no unique cost items for Downtown - Trinity Bluffs.

Unique cost items for Downtown - South Main/Rosedale include:

- Railroad and I-30 Underpass upgrades including structural modifications to lower pavement and traffic control for exclusive streetcar lane through underpass; cost \$4M. The upgrades and exclusive lane are necessary to ensure sufficient clearance to OCS contact wire, and to remove vehicles from the streetcar lane due to the low OCS contact wire height. Future engineering design should consider eliminating OCS through the underpass if battery operation is available on the streetcar vehicle.
- Minor railroad and I-35W underpass modifications on Rosedale; cost \$1M
- Reconstruction of intersection at Evans and Rosedale for new right-turn only lane (streetcar exempt) for end-of-line stop through new divided highway; modifications to existing signal system to add transit-only phase; cost \$250K

Unique cost items for Downtown - Jennings include:

- Railroad and I-30 Underpass upgrades including structural modifications to lower pavement and traffic control for exclusive streetcar lane through underpass; cost \$4M. The upgrades and exclusive lane are necessary to ensure sufficient clearance to OCS contact wire, and to remove vehicles from the streetcar lane due to the low OCS contact wire height. Future engineering design should consider eliminating OCS through the underpass if battery operation is available on the streetcar vehicle.

Unique cost items for Downtown - South Main/Magnolia include:

- Railroad and I-30 Underpass upgrades including structural modifications to lower pavement and traffic control for exclusive streetcar lane through underpass; cost \$4M. The upgrades and exclusive lane are necessary to ensure sufficient clearance to OCS contact wire, and to remove vehicles from the streetcar lane due to the low OCS contact wire height. Future engineering design should consider eliminating OCS through the underpass if battery operation is available on the streetcar vehicle.

### **3.0 Methodology for Other Costs**

The other items estimated for each alignment include:



- Right of way
- A maintenance and storage facility
- Streetcar vehicles
- Soft costs (professional services)
- Allocated and unallocated contingency

To estimate the cost of partial right-of-way takes along alignments, a right-of-way unit cost of \$220,000 per mile was assumed based on Tucson’s system. The total right-of-way cost is calculated by multiplying the per-mile right-of-way cost by the alignment’s route miles, and includes contingency and inflation factors.

It is assumed that each alignment will operate at 10 minute headways; therefore the number of streetcars is dependent on the length of each alignment, plus one spare vehicle. The number of streetcars is estimated from the alignment’s length. The unit cost of a streetcar vehicle was estimated from Tucson’s recent streetcar procurement. The cost of the MSF was assumed to be \$10 million, inclusive of property acquisition, yard tracks, maintenance building, site work, safety and security features, plus contingency and inflation factors. The right-of-way, MSF, and streetcar vehicle costs are then added to the construction subtotal for each alignment.

30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	\$	10,000
60	ROW, LAND, EXISTING IMPROVEMENTS (PER ROUTE MILE)	\$	220
70	VEHICLES (\$/VEHICLE; OIW 110 VEHICLE, TUCSON SPEC)	\$	4,000

*Note – costs shown in thousands*

Soft costs are estimated at 25% of the subtotal of all the above costs and a new subtotal is calculated. Unallocated contingency (project reserve) is then estimated at 10% of the subtotal, producing the total cost for each alignment. See the Results section of this memo and the attached Cost Estimate for resulting total costs for each alignment.

## 4.0 Results

The methodology for the Planning Cost Estimate described above was followed for each of the six alignments. Those results are summarized below and provided in the attached Cost Estimate spreadsheet.

Route	Route Miles	Total Cost	Cost per Route Mile
Downtown - West 7 <sup>th</sup>	3.00	\$128.8M	\$42.9M
Downtown - North Main	1.40	\$69.9M	\$49.9M
Downtown - Trinity Bluffs	2.20	\$98.7M	\$44.9M
Downtown - South Main/Rosedale	2.20	\$105.9M	\$48.1M
Downtown - Jennings	2.00	\$98.5M	\$49.2M
Downtown - South Main/Magnolia	3.20	\$138.3M	\$43.2M

**Fort Worth Streetcar**

**Planning Cost Estimate**

**DRAFT - 8.25.10**

**Notes:**

- All costs are shown in \$thousands
- Route miles are end-to-end for double track
- SCC Codes are based on Federal Transit Administration Standard Cost Categories

SCC	Per-Mile Costs (based on Tucson)	Base Cost (2010)	Alloc Conting	Escalation to Const Year	Subtotal
10	GUIDEWAY & TRACK ELEMENTS (route miles)	\$ 26,554	20%	5%	\$ 33,458
20	STATIONS, STOPS, TERMINALS, INTERMODAL (number)	\$ 3,060	20%	5%	\$ 3,856
40	SITWORK & UTILITIES	\$ 16,275	20%	5%	\$ 20,507
50	SYSTEMS	\$ 12,132	20%	5%	\$ 15,286
<b>SUBTOTAL (10, 20, 40, 50) (TUCSON)</b>					<b>\$ 73,106</b>
ROUTE MILES (TUCSON)					3.55
<b>BASE COST /ROUTE MILE (10,20,40,50)</b>					<b>\$ 20,593</b>

Fort Worth Alternatives		Downtown - West 7th	Downtown - North Main	Downtown- Trinity Bluffs	Downtown- Rosedale	Downtown- Jennings	Downtown- South Main		
	ROUTE MILES		3.00	1.40	2.20	2.20	2.00	3.20	
	BASE COST/ROUTE MILE		\$ 20,593	\$ 20,593	\$ 20,593	\$ 20,593	\$ 20,593	\$ 20,593	
	<b>BASE CONSTRUCTION SUBTOTAL (10,20,40,50)</b>		<b>\$ 61,780</b>	<b>\$ 28,831</b>	<b>\$ 45,305</b>	<b>\$ 45,305</b>	<b>\$ 41,187</b>	<b>\$ 65,899</b>	
<b>UNIQUE ITEMS PER ALIGNMENT</b>		<i>Unit Price</i>	<i>Unit</i>						
	Temporary Shoe Fly at Railroad Crossing	\$ 1,000	Lump Sum	\$ 1,000	\$ -	\$ -	\$ -	\$ -	
	Fully Upgraded Traffic Signal at Railroad Crossing	\$ 250	LS	\$ 250	\$ -	\$ -	\$ -	\$ -	
	Upgrade of Existing Paddock Viaduct	\$ 500	LS	\$ -	\$ 500	\$ -	\$ -	\$ -	
	Upgrade of Existing Underpass (Railroad and I-30)	\$ 4,000	LS	\$ -	\$ -	\$ 4,000	\$ 4,000	\$ 4,000	
	Upgrade of Existing Underpasses (Railroad and I-35W)	\$ 1,000	LS	\$ -	\$ -	\$ 1,000	\$ -	\$ -	
	Reconstruction of Evans & Rosedale Intersection	\$ 250	LS	\$ -	\$ -	\$ 250	\$ -	\$ -	
	<b>SUBTOTAL (Unique Items)</b>			<b>\$ 1,250</b>	<b>\$ 500</b>	<b>\$ -</b>	<b>\$ 5,250</b>	<b>\$ 4,000</b>	<b>\$ 4,000</b>
	<b>CONSTRUCTION SUBTOTAL (10,20,40,50,Unique Items)</b>			<b>\$ 63,030</b>	<b>\$ 29,331</b>	<b>\$ 45,305</b>	<b>\$ 50,555</b>	<b>\$ 45,187</b>	<b>\$ 69,899</b>
<b>30</b>	<b>SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS, PROPERTY</b>			<b>\$ 10,000</b>	<b>\$ 10,000</b>	<b>\$ 10,000</b>	<b>\$ 10,000</b>	<b>\$ 10,000</b>	
	RIGHT OF WAY BASE COST/ROUTE MILE		\$ 220	\$ 220	\$ 220	\$ 220	\$ 220	\$ 220	
	ROUTE MILES		3.00	1.40	2.20	2.20	2.00	3.20	
<b>60</b>	<b>RIGHT OF WAY (PARTIAL TAKES)</b>		<b>\$ 660</b>	<b>\$ 308</b>	<b>\$ 484</b>	<b>\$ 484</b>	<b>\$ 440</b>	<b>\$ 704</b>	
	VEHICLES (OIW 10T VEHICLE, TUCSON SPEC)		\$ 4,000	\$ 4,000	\$ 4,000	\$ 4,000	\$ 4,000	\$ 4,000	
	NUMBER OF VEHICLES (ASSUMED)		5	3	4	4	4	5	
<b>70</b>	<b>VEHICLES</b>		<b>\$ 20,000</b>	<b>\$ 11,200</b>	<b>\$ 16,000</b>	<b>\$ 16,000</b>	<b>\$ 16,000</b>	<b>\$ 20,000</b>	
	<b>SUBTOTAL (30,60,70)</b>		<b>\$ 30,660</b>	<b>\$ 21,508</b>	<b>\$ 26,484</b>	<b>\$ 26,484</b>	<b>\$ 26,440</b>	<b>\$ 30,704</b>	
	<b>CONSTRUCTION SUBTOTAL (10,20,30,40,50,60,70,Unique Items)</b>		<b>\$ 93,690</b>	<b>\$ 50,839</b>	<b>\$ 71,789</b>	<b>\$ 77,039</b>	<b>\$ 71,627</b>	<b>\$ 100,603</b>	
<b>80</b>	<b>SOFT COSTS (25% OF 10,20,30,40,50,70)</b>		<b>\$ 23,423</b>	<b>\$ 12,710</b>	<b>\$ 17,947</b>	<b>\$ 19,260</b>	<b>\$ 17,907</b>	<b>\$ 25,151</b>	
	<b>SUBTOTAL (10,20,30,40,50,60,70, 80,Unique Items)</b>		<b>\$ 117,113</b>	<b>\$ 63,548</b>	<b>\$ 89,737</b>	<b>\$ 96,299</b>	<b>\$ 89,533</b>	<b>\$ 125,753</b>	
<b>90</b>	<b>UNALLOCATED CONTINGENCY (10% OF 10,20,30,40,50,70,80)</b>		<b>\$ 11,711</b>	<b>\$ 6,355</b>	<b>\$ 8,974</b>	<b>\$ 9,630</b>	<b>\$ 8,953</b>	<b>\$ 12,575</b>	
	<b>TOTAL (10,20,30,40,50,60,70,80,90,Unique Items)</b>		<b>\$ 128,824</b>	<b>\$ 69,903</b>	<b>\$ 98,710</b>	<b>\$ 105,929</b>	<b>\$ 98,487</b>	<b>\$ 138,329</b>	
	ROUTE MILES		3.00	1.40	2.20	2.20	2.00	3.20	
	<b>COST /ROUTE MILE (10,20,30,40,50,70,80,90)</b>		<b>\$ 42,941</b>	<b>\$ 49,931</b>	<b>\$ 44,868</b>	<b>\$ 48,150</b>	<b>\$ 49,243</b>	<b>\$ 43,228</b>	