



Appendix B

Technical Memoranda and Reports

Technical memoranda and reports were prepared as independent documents to support the preparation of the Draft Environmental Impact Statement (DEIS) for the Cotton Belt Corridor Regional Rail Project. Information from these documents was incorporated into the DEIS to provide information on existing conditions, and in some cases assess potential impacts to the resources. Information contained in the DEIS is the most current and supersedes information in the technical memoranda and reports



B-21

Capital Cost Estimating
Methodology Technical
Memorandum



Memo

Date: January 4, 2018

Project: DART Cotton Belt Regional Rail Project – DFW International Airport to Shiloh Road

To: Chad Edwards, DART Assistant Vice President Capital Planning
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From: Tom Shelton, HDR Program Manager GPC6

Subject: Capital Cost Estimating Methodology Technical Memorandum

Introduction

DART has much documentation of the actual costs for the design, construction, operations, and maintenance costs as the direct result of implementing 93 miles of light rail transit (LRT) service and the 35-mile Trinity Railway Express (TRE) commuter rail service projects; most recently witnessed with the actual expended costs for the South Oak Cliff Corridor Blue Line Extension (SOC-3) project which opened in October 2016. For future System Planning and Corridor Planning efforts, this actual cost documentation is very beneficial in its usage of developing planning-level and project development-level cost estimates using either a “parametric unit price” or “cost per mile” estimating methodology for the various typical scenarios. In addition, this cost estimating methodology is continuously reviewed and updated at each of the quarterly meetings with FTA Region VI and the Project Management Oversight Consultant (PMOC) staffs, as well as recently submitted for review to FTA with the September 2017 Annual Update for the DART Downtown Dallas Second Light Rail Alignment Project (D2).

Cost Estimating Methodology

The development of capital cost estimates for the Cotton Belt Corridor Regional Rail project has been conducted using the same methodologies for previous DART passenger rail corridor projects in the planning stage, including the recently opened Green and Orange Lines, and South Oak Cliff Corridor Blue Line Extension project. Specific elements of the cost estimates, such as unit prices and add on allowances, have been updated to reflect current construction industry experienced costs in North Texas. In addition, actual costs incurred during the build-out construction of both the DART LRT Green and Orange Lines, as well as recently opened Line Section SOC-3, the DCTA A-Train commuter rail project, and the under construction TEXRail commuter rail project, for final design and construction activities have been relied upon as confirmation of unit prices used.

Capital cost estimates are represented in current year 2017 dollars, with an escalation to 2018 dollars. The cost estimates use parametric unit prices (unit cost per route foot) and special condition costs for the majority of the cost effort. The parametric unit costs are based on a level of detail appropriate for conceptual engineering and project development phases. The parametric unit costs are an estimate developed for all elements included in a typical cross section for a unit of measurement (route feet,



each, etc.). The parametric cost is then multiplied by the total length of the project for the total cost of that element.

In addition, the unit prices used for the Cotton Belt Corridor construction considered and benefitted from recent North Texas commuter rail projects, such as TEXRail and DCTA A-Train implementation from items such as:

- Unit costs for similar diesel multiple unit (DMU) modern commuter rail technology vehicles
- Pricing of equipment maintenance facilities for storage and maintenance of similar vehicles
- Pricing for regional commuter rail stations with similar amenities
- Pricing for systems and safety items, such as positive train control, signaling, and communication systems

Lastly, the contingency factors were reviewed to ensure they account for the planned implementation method of Design/Build delivery method, as well as key community impact issues.

Contingency Factors and Add-On Allowances

Once the typical “unit cost per route foot” and/or “cost per mile” estimates were determined at a basic civil cost level, several allowances and add-on factors are applied. These factors are added to account for uncertainty of the estimates at this level given that little or no design has been completed, and also account for the costs of non-construction items such as engineering design, construction management, and insurance. In addition to these factors, there are also assumptions for right-of-way costs, costs for environmental assessment and mitigation, and costs for vehicles and maintenance facilities.

The DART Capital Cost Methodology format is outlined below, using an example of a \$100 million basic civil cost:

\$100.0 (A)	Basic Civil Cost (SCC Sum Categories 10-50 including Guideway (SCC 10), Stations (SCC 20), Support Facilities (SCC 30), Sitework & Special Conditions (SCC 40), and Systems (SCC 50))
<u>+ \$30.0 (30% of A)</u>	Design Contingency
\$130.0 (B)	Subtotal Construction Costs
+ \$13.0 (10% of B)	Unallocated Contingency (SCC 90)
<u>+ \$42.9 (33% of B)</u>	Add-on Allowances (SCC 80)
\$185.9 (C)	Subtotal
+ \$19.5 (15% of B)	Real Estate, Rights-of-Way, Land (SCC 60)
+ \$1.3 (1% of B)	Environmental Allowance
+ <i>Vehicle Cost</i>	Vehicles (SCC 70)
+ <i>Maintenance Facility Cost</i>	<u>Support Facilities (SCC 30)</u>
\$206.7 (D)	Total Capital Cost



A brief description and example of the contingencies and add-ons is as follows:

- Design Contingency** – A 30 percent design contingency is added to the civil cost in the estimate to cover possible changes in unit costs that may occur as selected projects progress through the various stages of design development. Generally, this percentage is reduced as the project progresses through the conceptual, preliminary and final stages of design; therefore, less reserve is needed with more design (further described in Table 1). At the system-level stage, where minimal design has been done, a relatively high percentage of design contingency is included. For the Cotton Belt Regional Rail Corridor project, a 30% Design Contingency was used at the 10% Level of Design due to the level of unknown field conditions throughout the long 26 mile corridor and the many jurisdictions encountered.

Table 1. Percent Design Contingency Reduction as Project Progresses

Level of Design	% Design Contingency
2 – 10%	20% - 30%
30%	15%
65%	10%
95%	5%
100%	0%

- Unallocated Contingency** – A 10 percent contingency is added to the construction cost estimate to cover the expense of unforeseen costs incurred by contractors during construction. This is also referred to as an unallocated contingency. This is the FTA SCC 90.0 as noted above.
- Add-On Allowance** – An additional 33 percent add-on allowance is added to the construction costs. This covers the administrative cost of planning, support services, insurance, preliminary and final design, project management and construction management that are needed to construct a project, which are consistent with the items identified in the FTA Standard Cost Category (SCC) worksheets and further described in Table 2. 80.08 Start-Up was adjusted from the traditional 1% to 2% to account for unforeseen expenses associated with testing of the new technology vehicles.

Table 2. Definition of Add-On Allowances

SCC Section 80	Add-On Allowance Item	Percentage Applied
80.01	Project Development (Preliminary Engineering)	4.00%
80.02	Engineering (Final Design)	6.00%
80.03	Project Management of Design and Construction	5.00%
80.04	Construction Administration and Management	8.00%



80.05	Professional Liability and other Non-Construction Insurance	2.00%
80.06	Legal, Permits, Review Fees by other agencies, cities, etc.	3.00%
80.07	Surveys, Testing, Investigation, Inspection	3.00%
80.08	Start-Up (higher 2% used for Cotton Belt Corridor due to new vehicle technology proposed for DART)	2.00%
	Total	33.00%

- Real Estate (Right of Way)** – The DART Real Estate Department estimates that real estate costs for a new alignment can be calculated by adding approximately 11-15 percent of the total construction costs to the final cost estimate as more fully defined in Table 3. DART corridors have typically been constructed in more urban portions of the DART service area. To allow for a wide variety of land types considered in System Planning and Corridor Planning efforts, a percentage is used depending on the appropriate urbanization classification for that particular project location. This percentage will be used to estimate real estate costs.

Table 3. Real Estate Cost Classifications

<i>Urbanization Class</i>	<i>Real Estate %</i>
Central Business District	15 - 20%
Outer Business District	14%
Urban Residential	13%
Suburban Residential	12%
Rural	11%

Source: DART 11/17/00 Memo from John Haenftling. ROW cost range is 11%-20% of construction costs.

For the Cotton Belt Regional Rail Corridor project, a percentage of 15% was used for all Real Estate cost related items, including full acquisitions, partial acquisitions, relocations, temporary easements, temporary staging areas, etc. This higher, more conservative percentage was used at this stage of design until real estate needs are better defined and due to the likelihood the contractor will experience some higher-than-normal construction constraints in some areas of the corridor including residential areas and denser mixed use areas.

For the new 12th Street Red Line Light Rail Station, a percentage of 5% for all Real Estate costs was used due to the implementation of the added station to the Red Line will be within an existing DART-owned right-of-way, with any additional right-of-way needs for construction to be very minimal.

- Environmental Allowance** – With SCC 60.01 Real Estate costs, an additional 1% of construction cost is added to cover potential environmental mitigation not included in the civil cost.



- **Vehicles** – For the Cotton Belt Regional Rail Corridor project, it is assumed that a modern diesel multiple unit (DMU) commuter rail technology vehicle will be selected for operations, similar to the selected TEXRail vehicle. The TEXRail vehicle costs \$12,850,000 (2017 dollars) each including all needed spare parts.
- **Maintenance Facility** – For the Cotton Belt Regional Corridor project, it was determined that a new maintenance facility was required, in order to avoid any unnecessary dead-end run times to existing facilities, either at the TRE Irving Yard or the DCTA A-Train Maintenance Facility. Using similar pricing as incurred on both the recently-completed TEXRail Maintenance Facility and DCTA A-Train Maintenance Facility, a total cost of \$36,000,000 (2018 dollars) was assumed for site development, track, and building facilities.

Annual Inflation

To account for inflation for use in estimating Year of Expenditure (YOE) dollars, as well as future financial plan analysis, the estimates are inflated at a rate of 3.50% annually. This is the historical rate of inflation based on the Construction Cost Index (CCI), as well as recent Federal Transit Administration (FTA) guidance.