

APPENDIX G: Cost Estimating Details

DART Station Properties

At NCTCOG and DART's direction, no additional contingencies were provided to account for the pre-design nature of the estimates, made without benefit of survey, subsurface utility investigation, or engineering design practices.

Most engineering projects at early design submittals such as 30% include additional contingencies to account for unknown design details to be addressed later in design. These contingencies are typically lowered with each successive design submission and then minimized by final 100% design submission once all design procedures have been completed.

Without additional contingencies to supplement the preliminary nature of the OPCC's, the uncertainty inherent in this decision was mitigated by a general attempt to be conservative in quantity and unit price estimation. Unit prices and other elements of the OPCC's were developed consistent with the assumptions used for the half-mile areas surrounding each station.

Half-Mile Areas

Opinions of Probable Construction Cost (OPCC) were developed for each high-priority improvement that was not assumed by City staff to be built as part of another project (developer, City, TxDOT, etc.) in the near future.

OPCC's were not developed for *individual* low- or medium-priority improvements, but could be developed by the City in the future based on similar assumptions as outlined below. Rather, estimates for the overall cost of low- and medium-priority improvements were developed on a unit length basis for each station area. The low- and medium priority OPCC estimates are therefore of a lower fidelity and thus the City may consider verifying them with more detailed individual improvement estimates prior to making further design or construction funding decisions.

The following is a discussion of simplifying assumptions that were made in order to provide quality, yet preliminary OPCC's for the DART Station on-site improvements and nearly 1,100 separate high-priority improvements totalling nearly 58 linear miles over the 28 station areas project-wide.

Table G1 lists the project-wide number and length of improvements *not* assumed to be built by others. The listing is organized by station area, priority and type of improvement (sidewalk/shared use path vs. crosswalk).

Unit Costs

Consultants compared TxDOT and City of Dallas unit prices from recent bid tabulations for various items related to construction of the proposed improvements.

Adjustments were made in the comparisons due to differences in how the specifications, measurement, and payment for the City of Dallas and TxDOT are written. For example, the comparisons were made more balanced by averaging the Dallas values for different spellings of the same item number, or by adding remove and replace items together for comparison with an item that included both in the other agency's specifications.

TxDOT unit prices were in most cases much less expensive for sidewalk related items. This may be because TxDOT is the beneficiary of economies of scale from their contractors on projects of larger size where the items being constructed are contiguous, even though the City on their projects probably builds more sidewalk-related items overall. While this theory is impossible to confirm, since the Dallas prices don't have meta-data like TxDOT does on the quantities and number of times each item was used, the project team felt this effect was most likely present in the data nonetheless.

The City of Dallas bid tabulations also featured a wider array of bid items that would be used in these type of projects compared to the TxDOT standard bid items. Nonetheless, there were some bid items identified from TxDOT that were not available in the City list of bid items. In these cases, or when TxDOT listed a higher, more conservative unit price, the TxDOT items were used for OPCC's for this project.

In all other cases, including for the unit price for sidewalk, City of Dallas unit prices were used. The project team believes that City of Dallas prices would more likely reflect what local contractors would be bidding for sidewalk projects based on size of the proposed construction packages and our experience completing these type of projects in the DFW Metroplex.

Standard Assumptions

The following standard assumptions were used for most OPCC's developed for this project, though exceptions were sometimes made on a case-by-case basis as per engineering judgment.

Facility Width & Alignment

- All new and reconstructed sidewalks were assumed to be 5 feet wide.
- All shared use paths were assumed to be 10 feet wide.
- Sidewalks and shared use paths were assumed to have alignments that could meander slightly around obstacles if necessary and if permitted by the apparent right-of-way width.

Buffer Space & Setbacks

- Reconstructed sidewalk was assumed to be set back from the street where remnants of existing sidewalk had also been set back.
- For new sidewalk, a buffer between the sidewalk and roadway edge was assumed where the apparent available right-of-way seemed to be generally at least 8 feet wide.

Curb & Gutter

- Where sufficient space for buffers did not appear to exist, or where existing, damaged sidewalk that needs to be replaced is attached to the roadway curb, removal and replacement of any existing curb and gutter was assumed to also be necessary, so these costs were also included.
- New curb, gutter, and drainage systems were assumed to be necessary where not existing adjacent to sidewalk gaps.



Retaining Walls

- Retaining walls were estimated to be needed for certain lengths and heights based on engineering judgement where slopes were deemed steep enough to require them.
- Unit costs for retaining walls were estimated based on City of Dallas standard details for short retaining walls and the unit prices for their component features as follows:
 - 1' wall height = \$20/linear foot
 - 2' wall height = \$40/linear foot
 - 3' wall height = \$75/linear foot
 - 4' wall height = \$100/linear foot
 - 5' wall height = \$125/linear foot

Landscaping

- A two-foot strip of sod was assumed to be needed on each side of the work area in addition to the landscaping allowance noted below.
- Removal and replacement of trees were developed as a blended cost estimate between TxDOT costs for the item "Remove Tree and Install Plant Material" and City of Dallas costs for installing trees.

Driveways

- Standard sizes were developed for assumed reconstruction of residential and commercial driveways where needed to construct level sidewalk crossings. The standard sizes (250 sq. ft. for residential and 500 sq. ft. for commercial) helped simplify the task of making variable estimates for hundreds or thousands of driveways project-wide. Instead, estimators needed only to count the number of each type of driveway likely to be affected.
- Greater variability than indicated in the estimates may be expected in the actual construction cost in areas with steeper slopes near driveway crossings.

Table G1: Summary Improvement Statistics by Station Area, Priority & Improvement Type

Station Area	High Priority Improvements				Medium Priority Improvements				Low Priority Improvements				Gaps to Remain	
	Sidewalks & Shared-Use Paths		Crosswalks		Sidewalks & Shared-Use Paths		Crosswalks		Sidewalks & Shared-Use Paths		Crosswalks			
	#	Miles	#	Miles	#	Miles	#	Miles	#	Miles	#	Miles	#	Miles
1A Parker Rd	15	1.57	8	0.15	12	0.71	3	0.12	12	0.31	1	0.08	4	0.28
1B Downtown Plano	26	1.17	8	0.08	59	3.09	2	0.02	48	2.32	1	0.01	8	0.71
1C CityLine Bush	25	2.14	9	0.13	17	1.85	3	0.04	13	0.90	0	-	6	0.20
2A Galatyn Park	8	0.60	6	0.11	12	0.46	5	0.10	21	1.64	7	0.11	11	1.09
2B Arapaho Center	13	0.51	3	0.02	11	0.46	2	0.02	16	1.50	1	0.00	11	1.40
2C Spring Valley	7	0.32	3	0.04	9	0.29	1	0.01	18	1.32	2	0.03	12	0.61
3A Downtown Garland	54	3.65	3	0.03	69	2.93	4	0.05	65	1.94	5	0.04	9	0.25
3B Forest Jupiter	26	3.28	4	0.07	16	1.38	0	-	25	1.72	1	0.02	0	-
3C LBJ Central	29	2.31	3	0.04	19	1.80	0	-	6	0.33	0	-	2	0.02
3D Forest Ln	15	0.83	5	0.10	18	1.08	0	-	33	1.13	1	0.01	0	-
4A Walnut Hill	11	0.66	3	0.06	22	1.77	0	-	4	0.35	0	-	3	0.10
4B Park Lane	35	3.03	3	0.07	23	1.35	0	-	15	0.82	0	-	3	0.11
4C Lovers Lane	11	0.45	0	-	5	0.20	2	0.02	5	0.08	4	0.04	20	0.24
4D Mockingbird	5	0.19	1	0.02	6	0.25	2	0.03	35	1.61	0	-	11	0.77
4E LBJ Skillman	32	3.89	1	0.02	16	1.00	1	0.02	35	1.61	3	0.04	3	0.32
4F White Rock	21	2.13	3	0.05	29	2.73	2	0.02	45	3.30	1	0.02	1	0.06
5A Eight and Corinth	39	2.15	5	0.08	47	2.57	0	-	42	1.36	0	-	6	0.25
5B Dallas Zoo	57	3.09	1	0.01	54	2.45	0	-	45	1.25	0	-	1	0.07
5C Morrell	58	2.30	5	0.06	34	2.01	1	0.02	48	1.53	2	0.03	3	0.40
6A Tyler Vernon	63	4.24	4	0.06	78	4.76	10	0.12	97	3.59	5	0.06	1	0.03
6B Hampton	60	2.05	8	0.13	65	2.22	2	0.02	71	2.33	3	0.05	0	-
6C Westmoreland	44	2.46	15	0.23	39	1.46	3	0.13	45	1.63	1	0.02	0	-
7A Illinois	126	4.74	19	0.23	135	5.18	4	0.04	78	2.98	1	0.01	0	-
7B Kiest	41	2.20	0	-	83	3.95	4	0.05	67	2.70	3	0.04	0	-
7C VA Medical	55	2.65	9	0.07	69	3.43	9	0.11	75	2.93	2	0.02	6	0.49
8A City Place	3	0.03	11	0.16	4	0.40	1	0.01	21	0.67	6	0.08	1	0.21
8B Convention Center	8	0.34	2	0.04	4	0.69	2	0.04	3	0.06	1	0.01	6	0.27
8C Cedars	43	1.25	10	0.12	32	1.39	3	0.03	20	0.97	0	-	9	0.62
Totals	930	54.23	152	2.16	987	51.86	66	1.00	1008	42.90	51	0.73	137	8.48

Total High-Priority Improvements (Sidewalks + Shared Use Paths + Crosswalks) = 1,082
 Total High-Priority Improvements (Sidewalks + Shared Use Paths + Crosswalks) = 56.39 miles

Streetlighting

- Where new streetlighting was recommended in conjunction with proposed crosswalk improvements, standard unit prices for the entire installation were developed for different roadway cross sections as follows:



- Two-lane undivided street = \$26,500
 - Three-lane undivided street = \$27,200
 - Four-lane undivided street = \$40,500
 - Four-lane divided street = \$41,200
 - Six-lane undivided street = \$41,900
 - Six-lane divided street = \$42,700
- For purposes of the OPCC's, streets with medians less than 6' wide were considered undivided, with luminaire poles only on intersection corners rather than mounted in the median.
 - For segments of new streetlighting along sidewalk segments on DART property, site-specific streetlighting estimates were developed.

Signals & Beacons at Crosswalks

For crosswalks where proposed traffic signal, Pedestrian Hybrid Beacon (PHB), or Rectangular Rapid Flashing Beacon (RRFB) installations are recommended, the following standard unit prices per installation were developed based on improvement type and roadway cross-section, based on typical recent experience with previous projects:

- RRFB – Three-lane crossing without median island - \$24,000
- RRFB – with one solar unit sign with flashers/pushbutton in median refuge island - \$36,000
- RRFB – with two solar unit signs with flashers/pushbutton in median refuge island - \$48,000
- PHB or Pedestrian Traffic Signal – Three-lane undivided - \$150,000
- PHB or Pedestrian Traffic Signal – Four-lane divided - \$175,000
- PHB – Six-lane divided - \$200,000
- Pedestrian Traffic Signal – Six-lane divided - \$210,000
- Add APS pushbuttons, countdown pedestrian heads at existing signal - \$3,500 per intersection + \$6,000 per crosswalk

Road Diets

- Where road diets are recommended to provide shorter pedestrian crossings and/or provide space for pedestrian amenities such as median refuge islands and posts for signs, beacons and/or pushbuttons, the recommendations are made for consideration with the understanding that further, corridor-wide analysis outside the scope of this project will be required.
- The costs estimated are for making changes within a block in either direction of the pedestrian crossing, which would likely be the minimum viable improvement. In many cases, cities may consider a longer corridor for road diet implementation if spare capacity for auto traffic along the route is confirmed. However, costs associated with additional project length, or other costs associated with reconstructing curbs and islands beyond the one-block transition area or changes to signalized intersections, have not been included since they would difficult to estimate without additional study.

Median Anti-Climb Fencing

At a few locations where eliminating barriers to more direct pedestrian travel was determined to be impractical, aesthetic, anti-climb fencing is recommended to channelize pedestrians to the safest street crossings a reasonable distance away. City of Dallas and TxDOT standard bid items

were found to be insufficient to account for this type of fencing. Consultants identified two aesthetic, anti-climb fencing system products and requested pricing information on each from vendors and contractors. Photographs of the types of fencing available have been included in the figures shown previously for the relevant locations.

Criteria in identifying a suitable type of fencing for these applications were that it be tall enough and without hand or finger holds to allow it to be climbed. Also, since several systems would be installed in close proximity to moving traffic, it should either be crashworthy as a stand-alone installation or capable of being mounted on crash-tested standard median concrete traffic barrier.

One type of custom fencing identified had been built in recent years along the relatively narrow median of a high-speed state highway near touristed beach areas in Ocean City, Maryland. Consultants spoke with the vendor who provided the fencing and the contractor who built it. It was built to resemble a white picket fence, with pointed bars at the top to discourage climbing. The fencing was mounted on breakaway supports and a specially designed concrete foundation for wind loading in an area prone to hurricanes.

The contractor indicated the bid cost for this fencing was about \$440 per linear foot, which included all miscellaneous related items such as mobilization and temporary traffic control. The same wind load and foundation design would not likely be required for fencing in North Texas, but it isn't clear how much cost savings might be achieved with this change.

The contractor did not have examples of this type of fencing being built on top of concrete traffic barrier that would reduce the maintenance requirements for the fencing. If struck by errant vehicles traversing the curbed median, a significant amount of labor would be involved in replacing damaged sections.

The other type of fencing system identified was the ClearVu Invisible Wall system from Cochrane USA. This system was used as median pedestrian fencing in a recent project by TxDOT in the City of Fort Worth on Lancaster Ave. Quotes for fencing systems were obtained from Cochrane USA for the specific locations recommended for this project. Pricing varied from \$52 to \$73 per linear foot for the entire system, depending mostly whether the fencing was to be installed on ground mounted posts in wide medians or away from roadways or on top of concrete traffic barriers in narrow medians.

For the Lancaster Ave project, where a wide median was available, TxDOT indicated that bid prices including contractor labor for the project were about \$90 per linear foot. However, a representative from the contractor was also contacted and indicated that he would bid a higher price of \$130 to \$140 per linear foot for future contracts. Their experience after installing the fencing for the first time was that it was a labor-intensive process that would not go more quickly with additional experience. Another local contractor who has installed this type of fencing on other projects indicated a typical bid price of \$110 to \$120 per linear foot.

After reviewing the above information, consultants decided on a unit cost of \$130 / linear foot for anti-climb pedestrian fencing. This was based on 6' high fencing for stand-alone applications, or 3.5' fencing on top of 2.5' tall concrete traffic barrier for a total barrier height of 6' in narrow median applications. The \$130 per linear foot value provides for a relatively generous extra labor allowance for the Clearview Invisible Wall system and/or for vendors of other similar products to be identified.

Where median anti-climb fencing is recommended on top of concrete traffic barrier, standard TxDOT bid items for constructing concrete traffic barrier and end treatments were assumed independent of the cost of the remainder of the fence.

Right-of-Way

- No right-of-way acquisition is assumed for any improvements. Right-of-way data was unavailable for the high-level planning purposes of this study. Some assumptions about the apparent right-of-way location were made based on factors such as the location of utility poles in order to make other assumptions necessary for cost estimation.
- Some improvements on private property (such as that of hospitals or other large employers) assume that cooperation of the property owners and negotiation of easements would be necessary. However, no additional cost has been assumed for these activities.

Contingencies

The following contingencies (totaling 25%) were applied to all costs, as directed and approved by both NCTCOG and DART:

- 10% design fee
- 4% mobilization
- 4% for landscaping allowance
- 2% for Erosion & Sediment Control Allowance
- 3% for traffic control
- 2% extra contingency for federal aid project

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