CHAPTER 11
BRIDGE DEVELOPMENT REPORT
COST ESTIMATING

11.1 General

The purpose of the Bridge Development Report is to select the most appropriate structure type for the site under consideration. One of the most important considerations is to select the most cost efficient bridge to fit the unique circumstances at the site. The purpose of the procedure established in this chapter is to bring uniformity to the cost estimating portion of the decision making process. For information purposes selected project cost data is provided in the appendix.

The cost estimating procedure supplied herein should be used for all bridge structures with the exception of the structure types stated below. This process is not suitable for cost estimating structure types without repeatable bid history including the following bridge types: movable; cable stayed; cast-in-place on form travelers; arches and tunnels. These very unique structures should be cost estimated by the use of fundamental process of developing cost based on labor, materials, equipment and construction time.

This concept for cost estimating is a three-step process. The first step is to utilize the average unit material costs provided herein to develop a cost estimate based on the completed preliminary design. The second step is to adjust the total bridge cost for the unique site conditions by use of the site adjustment factors. The third and final step is to review the computed total bridge cost on a cost per square foot basis and compare this cost against the historical cost range for similar structure types. This three-step process should produce a reasonably accurate cost estimate for structure type selection. However, if a site has a set of odd circumstances, which will affect the bridge cost, be sure to account for these unique site conditions in the estimate. If the estimated cost is outside the cost range in step three, documented reasons should be provided for the variance in cost.

11.2 Cost Estimating Process

The applicability of this three-step process is explained in the general section. The process stated below is developed for estimating the bridge cost after the completion of the preliminary design, which includes member selection, member size and member reinforcing. This process will develop costs for the bridge superstructure and substructure from beginning to end bridge. Costs for all other items including but not limited to the following are excluded from the costs provided in this chapter: mobilization, operation costs for existing bridge(s); removal of existing bridge or bridge fenders; lighting; walls; deck drainage systems; embankment; fenders; approach slabs; maintenance of traffic; load tests; bank stabilization.

Step One:
Utilizing the cost provided herein, develop the cost estimate for each bridge type under consideration.

11.2.1 Substructure

A. Prestressed Concrete Piling; cost per linear foot (furnished and installed)

**Size of Piling	Driven Plumb or 1" Batter	Driven Battered
18 in	$38	$47
24 in	$53	$67
30 in	$63*	$80

*When heavy mild steel reinforcing is used in the pile head, add $250.
** When silica fume is used, add $6.0 per LF to the piling cost.

B. Steel Piling; cost per linear foot (furnished and installed)

14” x 73 H Section	$35
14” x 89 H Section	$38
20” Pipe Pile	$84
24” Pipe Pile	$90
30” Pipe Pile	$152

C. Drilled Shaft; cost per linear foot

1.) On Land with casing salvaged. (Total in-place cost)

3 ft	$239
4 ft	$277
5 ft	$340
6 ft	$441
7 ft	$542

2.) In water with casing salvaged. (Total in-place cost)

3 ft	$277
4 ft	$302
5 ft	$353
6 ft	$479
7 ft	$605
8 ft	$806

3.) In water with permanent casing. (Total in-place cost)

3 ft	$428
4 ft	$466
5 ft	$554
6 ft	$643
7 ft	$781
8 ft	$970
9 ft	$1184

D. Sheet Piling Walls
1.) Prestressed concrete; cost per linear foot.
10” x 30” $71
12” x 30” $86
2.) Steel; cost per square foot
Permanent Cantilever Wall.....$20
Temporary Cantilever Wall.....$6

E. Cofferdam Footing (cofferdam and seal concrete)
Prorate the cost provided herein based on area and depth of water. A cofferdam footing having the following attributes will cost $328,000.
Area; 63 ft x 37.25 ft. Depth of seal; 5 ft. Depth of water over the footing; 16 ft.

F. Substructure Concrete; cost per cubic yard.
Concrete.....$550
Mass concrete $315
Seal concrete.....$344
Shell fill $5
Admixtures
For calcium nitrite, add $32 per cubic yard. (@4.5 gal per cubic yard).
For silica fume, add $25 per cubic yard. (@60 lbs. per cubic yard.)

G. Reinforcing Steel; cost per pound.....$0.46

11.2.2 Superstructure

A. Bearing Material
1.) Neoprene Bearing Pads; Cost per Cubic Foot $500
2.) Multirotational Bearings, Cost per Each

Capacity in Kips	Cost
1-251	$3,465
251-500	$3,780
501-750	$4,410
751-1000	$5,040
1001-1250	$5,670
1251-1500	$6,300
1501-1750	$6,930
1751-2000	$7,875
>2000	$10,080

B. Bridge Girders

1.) Structural Steel; cost per pound (includes coating costs).

Rolled wide flange sections	$0.90
Plate girders; straight	$1.04
Plate girders; curved	$1.21
Box girders; straight	$1.32
Box girders; curved	$1.54

When uncoated weathering steel is used, reduce the price by $0.04 per pound. Inorganic zinc coating systems have an expected life cycle of 20 years.

2.) Prestressed Concrete Girders; cost per linear foot.

AASHTO Type II	$80
AASHTO Type III	$86
AASHTO Type IV	$100
AASHTO Type V	$120
AASHTO Type VI	$130
Fl Bulb Tee; 54”	$90
Fl Bulb Tee; 63”	$98
Fl Bulb Tee; 72”	$120
Fl Bulb Tee (M); 78”	$135
78” Haunched units (CJ to CJ)	$380
Fl Double Tee; 18”	$185
Fl Double Tee; 24”	$200
Fl Double Tee; 30”	$270
Fl Inverted Tee; 16”	$50*
Fl Inverted Tee; 20”	$56*
Fl Inverted Tee; 24”	$62*
Fl Inverted Tee; 16”	$50*
Fl Tub (U-Beam); 48”	$300*
Fl Tub (U-Beam); 54”	$330*
Fl Tub (U-Beam); 63”	$370*
Fl Tub (U-Beam); 72”	$400*
Solid Flat Slab (36’x15”)	$110
Solid Flat Slab (36’x18”)	$125

* Price is based on ability to furnish products without any conversions of casting beds and without purchasing of forms. If these conditions do not exist, add the following costs:

Inverted Tee - $202,000
Fl Tub - $403,000

3.) Cast-in-Place Superstructure Concrete; cost per cubic yard.

Box Girder Concrete; straight	$650
Box Girder Concrete; curved	$675
Deck Concrete	$425

4.) Concrete for Pre-cast Segmental Box Girders; cantilever construction; price per cubic yard. For deck area between 300,000 SF and 500,000 SF, interpolate between the stated costs per cubic yard.
<=300,000 SF $693
>300,000 SF and <=500,000 SF .....interpolate
>500,000 SF.....$567
5.) Reinforcing Steel; cost per pound $0.46
6.) Post-tensioning Steel; cost per pound.
Strand; longitudinal.....$1.53
Strand; transverse $1.82
Bars.....$3.90
7.) Railings and Barriers, cost per linear foot.
Traffic Barrier $44
Pedestrian Railing $57
Bicycle Railing..... $69*
*For metal railing add $38 per linear foot.
8.) Expansion joints; cost per linear foot.
Strip seal $106
Finger joint <6” $315
Finger joint >6” $473
Modular 6” $500
Modular 8” $700
Modular 12” $900

C. Retaining Walls
1.) MSE Walls; Cost per square foot
Permanent.....$23
Temporary.....$8

D. Noise Wall; Cost per square foot $18

E. Detour Bridge; Cost per square foot $10*
*Using FDOT supplied components. The cost is for the bridge proper and does not include approach work, surfacing, or guardrail.

11.2.3 Design Aid for Determination of Reinforcing Steel

In the absence of better information, use the following quantities of reinforcing steel per cubic yard of concrete.

Pile abutments 135
Pile Bents.....145
Single Column Piers; Tall (>25 ft).....210
Single Column Piers; Short (<25 ft).....150
Multiple Column Piers; Tall (>25 ft) 215
Multiple Column Piers; Short (<25 ft) 195

Bascule Piers 110
Deck Slabs; Standard 205
Deck Slabs; Isotropic 125
Concrete Box Girders; Pier Segment 225
Concrete Box Girders; Typical Segment 165
Concrete Box Girders; Flat Slabs (30 ft x 15” deep).....220

Step Two:
After developing the total cost estimate utilizing the unit cost, modify the cost to account for site condition variables. If appropriate, the cost will be modified by the following variables:

1. For rural construction decrease construction cost by 6 percent.
2. For urban construction (Broward, Dade, Duval, Hillsborough, Orange, Palm Beach and Pinellas counties), increase construction cost by 6 percent.
3. For construction over water increase construction cost by 3 percent.
4. For phased construction (over traffic or construction requiring multiple phases to complete the entire cross section of the bridge), add a 20 percent premium to the affected units of the structure.

Step Three:
The final step is a comparison of the cost estimate with historic bridge cost per square foot data. These total cost numbers are calculated exclusively for the bridge cost as defined in the General Section of this chapter. Price computed by Steps 1 and 2 should be generally within the range of cost of as supplied herein. If the cost falls outside the provided range, good justification must be provided.

Bridge Superstructure Type	Total Cost per Square Foot
Reinforced Concrete Flat Slab; Simple Span	$50-65*
Reinforced Concrete Flat Slab; Continuous Span	$60-80*
Steel Deck/Girder; Simple Span	$62-75*
Steel Deck/Girder; Continuous Span	$70-90*
Prestressed Concrete Deck/Girder; Simple Span	$50-70*
Prestressed Concrete Deck/Girder; Continuous Span	$65-110*
Post-tensioned, cast-in-place Concrete Box Girder	
Cast on scaffolding; span length <=240 ft	$75-110
Steel Box Deck/Girder	
Span range from 150 ft to 280 ft	$76-120
For curvature add a 15 percent premium	
Segmental Concrete Box Girders	
Span range from 150 ft to 280 ft	$80-110
Movable Bridges; bascule spans & piers	$900-1500
Demolition of existing bridges	
Typical	$9-15
Bascule spans & piers	$63

* Increase the cost by twenty percent for phased construction.

11.3 Historical Bridge Costs

The unadjusted bid cost for selected bridge projects are provided as a supplemental reference for estimating costs. The costs have been stripped of all supplemental items such as mobilization, so that only the superstructure and substructure cost remain.

11.3.1 Deck/Girder Bridges

Project Name and Description	Letting Date	Deck Area (SF)	Cost per SF
Jenson Beach Causeway (890145)	01/02	150,679 78” BulbT, simple span	$59.00
SR 417/Turnpike (770616)	99/00	5,270 AASHTO Type VI	$50.39
US 98/Thomas Drive (460111)	02/03	167,492 U-Beam	$66.50
SR 704 over I-95 (930183 & 930210)	97/98	14,804 each AASHTO Type IV Simple Span	$60.66
SR 700 over C-51 (930465)	97/98	7,153 AASHTO Type II Simple Span	$46.46
SR 807 over C-51 (930474)	98/99	11,493 AASHTO Type III Simple Span	$48.77
SR 222 over I-75 (260101)	00/01	41,911 AASHTO Type III & IV	$63.59
SR 166 over Chipola River (530170)	00/01	31,598 AASHTO Type IV	$48.52
SR 25 over Santa Fe River (260112)	00/01	17,118 AASHTO Type IV	$52.87
SR 71 over Cypress Creek (510062)	00/01	12,565 AASHTO Type III	$49.64
SR 10 over CSX RR (580175)	00/01	12,041 AASHTO Type IV	$54.91
SR 291 over Carpenter Creek (480194)	00/01	7,760 AASHTO Type IV	$59.41
SR 54 over Cypress Creek (140126)	00/01	6,010 AASHTO Type III	$51.48
SR 400 Overpass (750604)	00/01	27,084 AASHTO Type VI	$48.15
Palm Beach Airport Interchange over I-95 (930485)	99/00	9,763 Steel	$85.50
Turnpike Overpass (770604)	98/99	7,733 Steel 179', Simple Span	$79.20
SR 686 (150241)	99/00	63,387 Steel	$73.31
SR 30 RR Overpass (480195 & 480196)	00/01	6,994 each	$118.35

11.3.2 Post - tensioned Concrete Box Girder, Segmental Bridges

Project Name and Description	Letting Date	Deck Area (SF)	Cost per SF
A1A over ICWW St. Lucie River, Evans Crary (890158)	97/98	297,453 Span by Span	$80.50
Palm Beach Airport Interchange at I-95 (930480)	99/00	77,048 Balanced Cantilever	$100.73
Palm Beach Airport Interchange at I-95 (930477)	99/00	20,925 Balanced Cantilever	$96.31
Palm Beach Airport Interchange at I-95 (930479)	99/00	69,233 Balanced Cantilever	$88.49
Palm Beach Airport Interchange at I-95 (930482)	99/00	47,466 Balanced Cantilever	$104.96
Palm Beach Airport Interchange at I-95 (930482)	99/00	81,059 Balanced Cantilever	$101.44
Palm Beach Airport Interchange at I-95 (930483)	99/00	90,926 Balanced Cantilever	$101.57
Palm Beach Airport Interchange at I-95 (930484)	99/00	41,893 Balanced Cantilever	$115.11
Palm Beach Airport Interchange at I-95 (930478)	99/00	20,796 Balanced Cantilever	$95.16
17th Street over ICWW Ft. Lauderdale (860623)	96/97	135,962 Balanced Cantilever	$74.71
Royal Palm Way SR 704 over ICWW (930507 & 930506)	00/01	43,173 each C-I-P on Travelers	$163.88
US 92 over ICWW Broadway Bridge Daytona (790188)	97/98	145,588 Balanced Cantilever	$81.93
US 92 over ICWW Broadway Bridge Daytona (790187)	97/98	145,588 Balanced Cantilever	$81.93
SR 789 over ICWW Ringling Bridge (170021)	00/01	329,096 Balanced Cantilever	$81.43
US 98 over ICWW Hathaway Bridge (460012)	00/01	575,731 Balanced Cantilever	$87.72

11.3.3 Post-tensioned Cast-in-place Concrete Box Girder Bridge (low level overpass)

Project Name and Description	Letting Date	Deck Area (SF)	Cost per SF
SR 858 over ICWW Hallandale Beach (860619 & 860618)	97/98	29,888 each	$83.25
SR 858 Flyover Hallandale Beach (860620)	97/98	21,777	$81.99
4th Street over I-275	94/95	12,438	$75.21

11.3.4 Bascule Bridge Cost

Deck area is calculated to be coping-to-coping width times overall bascule length including both bascule pier lengths and main span. Costs include all cost for moveable span, gates and bascule piers.

Closed Deck Bascule Bridges

Project Name and Description	Letting Date	Deck Area (SF)	Cost per SF
SR 45 over ICWW Venice (170170 & 170169)	99/00	8,785 each	$768
Royal Palm Way SR 704 over ICWW (930507 & 930506)	00/01	11,535 each	$1089
SR 858 over ICWW Hallandale Beach (860618 & 860619)	97/98	14,454 each	$811
Ocean Ave. over ICWW ICWW Boynton Beach (930105)	98/99	11,888	$1157
17th Street over ICWW Ft. Lauderdale (860623)	96/97	34,271	$865
2nd Avenue over Miami River (874264)	99/00	29,543	$1080