ESTIMATING PROCEDURE FOR MAJOR HIGHWAY
CONSTRUCTION BID ITEM COST

FINAL REPORT

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Introduction

The present procedure for estimating construction bid item cost
makes use of the quarterly weighted average unit price report
coupled with engineering judgment. The limitation to this method
is that this report format provides only the lowest bid data
distributed over the entire three-month period. Furthermore,
it fails to recognize the dependency of individual item bid
price to the quantity as has been determined on some major items.

Purpose and Scope

The major purpose of this effort is geared towards development
of an automated computerized method of forecasting bid item cost
for construction contract letting. Such development is confined
to bid items that comprise 75% of the total cost of the projects.

Procedure

Input

A necessary prerequisite to development of such a system is the
availability of a sound data file reflecting cost data for at
least two years. This has been done for 1975 through 1977. The
file contains comprehensive data on all projects let during these
years. All possible bids on a project are contained in this file.
Attachment 1 is a detailed description of the various items
contained in this file. The attachment is an instructional
attachment used for coding information and subsequent punching
on cards.

Although the file contains bid cost data on all possible items
included in a project, the system for forecasting is confined
to the following major items.

1. Unclassified Excavation   Item No. 203(1)
2. Base Course   Item No. 301(1)
3. Cement Stabilized Base Course   Item No. 303(1)
4. Asphaltic Concrete   Item No. 501(1)
5. P. C. C. Pavement   Item No. 601(1)(c)
6. Reinforcing Steel   Item No. 806(1)
7. Structural Steel   Item No. 807(1)
8. Structural Concrete   Item No. 805(3)

Output

Two types of output can be retrieved through the system:

Output 1 lists the average of the first three minimum bid prices according to quantity for each period. This output also provides a columned output of the average of the first three minimum bid prices and the Department's estimate. These values tend to shift the estimate for that period in the direction of the bias data. The format of this output can be conveniently used to predict the estimate for succeeding period.

The second output is geared towards computation of the monthly construction cost index (CCI). The following algorithm is utilized in the computation.

A. Weighted monthly average for the selected items

B. Cost Index, $CI = \dfrac{\text{Weighted average in A}}{\text{The previous year's unit price}}$

C. Compute structural composites:

   1. Base Course Composite = Average of CI of Items 1, 2, 3

   2. Surface Composite   = Average of CI of Items 4, 5

   3. Structure Composite   = Average of CI of Items 6, 7, 8

D. Monthly CCI = Average of the above three composites

The output on this is still in the programming stage and, therefore, is not included in this report.

Implementation

The system, in one form or other, has been used to generate estimates of bid prices for items. No feedback is available as to the efficiency of the system. Engineering judgment will always govern the final estimates. However, the system will be monitored to evaluate the improvement, if any, in the estimating procedure.

The system has other potential uses. For example, cost analysis can be performed for various districts to determine regional variability. Cost per unit length can also be evaluated for various types of construction.

INSTRUCTIONS FOR CODING CONTRACT BID ITEM INFORMATION

| Use No. 2 or equivalent pencil |

CARD NO. 1: Project Number and Route Number Information

Column 1	Card No.	Always 1
Column 3-18	Project No.	
Column 20-35	Associated Project 1	
Column 37-52	Associated Project 2	
Column 54	Alternate or Layout	
Column 56-72	Route No.	US-190

CARD NO. 2: Project and Other Contract Related Information

Column 1	Card No.		Always 2
Column 3-4	Type of Construction - Codes as follows:		Coded from 1-12
	1 =	New Construction - Portland Cement Concrete (PCC)	
	2 =	New Construction - Hot Mix Asphaltic Concrete (HMAC) with base	
	3 =	New Construction - Bridges	
	4 =	Reconstruction - HMAC with base	
	5 =	Reconstruction - HMAC overlay	
	6 =	Reconstruction - PMS overlay	
	7 =	Reconstruction - PCC	
	8 =	Reconstruction - Bituminous Surface Treatment	
	9 =	Reconstruction - Bridges	
	10 =	Rest Areas	
	11 =	Safety	
	12 =	Signing	

For this field other combination of numbers may also be used except 10, 11 and 12.

For example: If the contract is for Reconstruction of a bridge with HMAC overlay, use the code "95", etc.

Column 6	Class of Construction	R = Rural U = Urban
Column 8	Number of lanes	9
Column 10	Median	1 = yes, 2 = no
Column 12-13	District	02 thru 05, 07, 08, 58, 61, 62
Column 15-16	Parish Number 1	1 through 64
Column 18-19	Parish Number 2	1 through 64
Column 21-26	Length of Project in Miles	99.999
Column 28-31	Work days allotted	9999
Column 33-40	Date contract let	MM-DD-YY
Column 42-50	Department Estimated Bid	999999999
Column 52-53	Number of Bids	99

CARD NO. 3: Contractor's Bid Information

All bid costs to be to the closest dollar (no pennies)

Column 1	Card No.	Always 3
Column 3-5	First contractor code	999
Column 7-15	First contractor bid cost	999999999
Column 17-19	Second contractor code	999
Column 21-29	Second contractor bid cost	999999999
Column 31-33	Third contractor code	999
Column 35-43	Third contractor bid cost	999999999
Column 45-47	Fourth contractor code	999
Column 49-57	Fourth contractor bid cost	999999999
Column 59-61	Fifth contractor code	999
Column 63-71	Fifth contractor bid cost	999999999

CARD NO. 4: Contractors Bid Information (Continued)

This card will be coded only if there are more than five bids.

Column 1	Card No.	Always 4
Column 3-5	Sixth contractor code	999

↓ | ↓ | ↓

| Column 63-71 | Tenth contractor bid cost | 999999999 |

CARD NO. 5: Bid Item Quantity and Cost Information

Column 1	Card No.	Always 5

The rest of the fields are free format with a blank separating each field. If
any item listed below is unavailable put a question mark character, thus "?".

Other notes for coding are:

* Quantity can be coded as LUMP
* Bid cost can be coded as FREE
* Each contractors bid price should follow the same order as in Card Nos. 3 and 4
  e.g. Bid cost 1 should correspond to first contractor code, etc.
* If more space is needed to complete all the available bid cost, continue on
  to the next card with card number and item number duplicated from the previous
  card.

Fields to be coded on this card:

* Item Number
* Quantity
* Department's estimated bid item cost
* First contractor's bid item cost
* Second contractor's bid item cost
* --------
* --------
* --------
* Last contractor's bid item

PERIOD	LOW	HI	N	QTY	AVG_OF_3	MIN_FACT	AVG_3_DE
1	0	5000	6	5628	13.75	14.99	13.31
1	20000	1000000	6	30070	14.35	16.11	15.26
2	0	5000	3	950	16.00	17.83	15.67
2	5001	20000	7	19040	15.90	17.20	15.34
3	0	5000	3	7275	18.69	21.06	18.14
3	5001	20000	4	6277	18.63	20.60	18.48
4	0	5000	3	4378	16.00	19.66	16.67
5	5001	20000	6	29864	17.70	19.81	16.92
6	0	5000	3	5686	28.84	34.18	25.01
6	5001	20000	4	11027	16.50	18.36	16.13
6	20000	1000000	4	103097	13.14	15.36	13.48
8	0	5000	4	9733	17.51	22.55	16.67
8	5001	20000	4	41143	14.71	15.57	14.70
9	0	5000	4	6362	22.81	26.37	21.13
10	0	5000	5	9628	23.71	27.68	22.70
10	5001	20000	5	19405	15.89	17.19	16.15
10	20000	1000000	4	74227	16.52	18.10	16.39
11	0	5000	4	2987	31.08	53.34	28.31
12	0	5000	3	1142	16.50	19.24	16.00
12	5001	20000	5	11260	10.50	14.81	11.63
13	0	5000	3	4453	24.88	25.10	24.92
13	5001	20000	3	5201	17.90	21.37	17.93
15	0	5000	10	499	22.00	25.29	21.50
15	20000	1000000	6	34840	11.37	12.30	12.23
16	0	5000	6	3399	21.33	22.15	20.25
16	5001	20000	8	19335	12.41	13.27	12.55
17	0	5000	2	7461	14.51	14.87	15.19
17	5001	20000	7	19359	16.24	19.25	15.86
17	20000	1000000	5	59182	14.67	16.71	14.50
18	0	5000	9	13834	17.33	19.46	18.03
18	5001	20000	5	31839	13.71	15.23	14.65
18	20000	1000000	4	57813	12.50	13.26	13.05
19	0	5000	6	864	12.73	14.26	13.30
19	20000	1000000	9	21691	11.33	12.27	12.50
20	5001	20000	6	10563	14.33	15.15	14.75
20	20000	1000000	6	30178	16.25	16.50	15.94
21	0	5000	1	4510	.	.	21.99
22	0	5000	4	348	21.20	26.25	19.65
23	20000	1000000	6	24809	14.17	16.21	14.38

Period 1 = Jan '75
Period 24 = Dec '76

Quantity interval

No of contracts in period

Quantity

Avg of 1st three minimum

Previous column + (2 × Std. Dev of that column) for each period)

Avg of these and the Debti estimate

6