# Construction Cost Estimate Based on Data Base System

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## 1. Introduction

In Japan, when the Ministry of Land Infrastructure and Transport (MLIT) or other public authorities wants to let out a construction work to general construction companies, they, in-house staffs, always estimate the construction cost from the beginning by themselves. They will not utilize the former bidding results or the former construction results at all. Instead they will estimate the cost by taking into account all of the labors needed, machines needed, etc. Consequently it takes really long time and huge man-power to get the results. But in foreign countries, such as USA, UK, Germany, France, they have a data base of former bidding results of construction companies. They utilize this data base to estimate the construction cost of future projects to secure the budget or to evaluate the bidding results. These systems of California Department of Transportation (Caltrans), UK and Germany are investigated and introduced here. Its application to the JBIC projects in developing countries is discussed.

## 2. Cost Estimate System of Caltrans

California is divided into several districts and in-house staffs of each district estimate the construction cost. Projects are advertised through the web pages of Caltrans with the Engineer's Estimate, which corresponds to the Japanese governmental estimated cost, that is the upper limit of the bidding. Whereas the Engineer's Estimate is not the upper limit. The bill of quantity of the Caltrans consists of unit items with item codes. Each item code corresponds to a certain kind of work and contains all necessary costs. In the Japanese estimation, the cost of one unit item consists of the direct cost and the indirect cost, which are not divided in the Caltrans estimation. The item code consists of six digits. First two digits correspond to the section number of the Caltrans' Standard Specification, which prescribes the general aspect of the work. In the special provisions which correspond to the Japanese Special Specification, the details of the work are prescribed together with the Standard Plans which schematically illustrate the works and define what is included in one unit of work. The content of works is strictly defined so that they can be repeatedly utilized in other projects. Also many standard plans are prepared to ease the standardization of not only the cost estimate but also the construction works. Table.1 shows the example of the priced bill of quantity. Table.1 and 2 are opened in the Caltrans' web pages together with other data.

Table.1 Priced Bill of Quantity of the First Bidder, Resurface Asphalt Concrete

| ITEM NO. | ITEM CODE | ITEM DESCRIPTION | UNIT OF MEASURE | ESTIMATED QUANTITY | BID | AMOUNT |
|---|---|---|---|---|---|---|
| 1 | 120090 | CONSTRUCTION AREA SIGNS | LS | LUMP SUM | 2,500.00* | 2,500.00 |
| 2 | 120100 | TRAFFIC CONTROL SYSTEM | LS | LUMP SUM | 33,000.00* | 33,000.00 |
| 3 | 128650 | PORTABLE CHANGEABLE MESSAGE SIGN | EA | 2 | 2,500.00 | 5,000.00 |
| 4 | 153103 | COLD PLANE ASPHALT CONCRETE PAVEMENT | M2 | 370 | 18 | 6,660.00 |
| 5 | 198007 | IMPORTED MATERIAL (SHOULDER BACKING) | TONN | 1,040 | 27 | 28,080.00 |
| 6 | 390095 | REPLACE ASPHALT CONCRETE SURFACING | M3 | 1,140 | 191 | 217,740.00 |
| 7 | 390102 | ASPHALT CONCRETE (TYPE A) | TONN | 3,000 | 48 | 144,000.00 |
| 8 | (S) 840561 | 100 MM THERMOPLASTIC TRAFFIC STRIPE | M | 19,040 | 1.25 | 23,800.00 |
| 9 | (S) 840570 | 100 MM THERMOPLASTIC TRAFFIC STRIPE (BROKEN 10.98 M - 3.66 M) | M | 1,270 | 1 | 1,270.00 |
| 10 | (S) 850111 | PAVEMENT MARKER (RETROREFLECTIVE) | EA | 855 | 5 | 4,275.00 |
| 11 | (S) 850122 | PAVEMENT MARKER (RETROREFLECTIVE-RECESSED) | EA | 460 | 20 | 9,200.00 |
| | | | | | TOTAL | 475,525.00 |

The engineer's estimate is 598,000.00US$. The price of the first bidder is 475,525.00US$, which is well

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below the engineer's estimate. In Table.2 the prices of other bidders are shown which differ considerably. The prices of the third bidder and the fourth bidder are well over the engineer's estimate. This is because the engineer's estimate is not the upper limit and contractors estimated their cost based on their productivity. In these bids, unit prices have a priority over the total cost. If a bidder makes a mistake to calculate the total cost, the total cost will be recalculated based on the bidden unit prices. These unit prices are not negotiated between a contractor and the client after the bid opening, and used for the calculation of monthly payment after a contract is awarded. All items of the bill of quantity must be checked by contractor monthly and the amount of finished work must be reported to the client. In Caltrans data base system, the bidden unit prices of all bidders are stored. In this case four bidders,

Table.2 Priced Bill of Quantity of Other Bidders

SUMMARY OF REMAINING BIDDERS

| ITEM | SECOND | | THIRD | | FOURTH | |
|---|---|---|---|---|---|---|
| | BID | AMOUNT | BID | AMOUNT | BID | AMOUNT |
| | | | | | | |
| 1 | 5,000.00* | 5,000.00 | 2,800.00* | 2,800.00 | 3,500.00* | 3,500.00 |
| 2 | 53,000.00* | 53,000.00 | 25,000.00* | 25,000.00 | 40,000.00* | 40,000.00 |
| 3 | 5,000.00 | 10,000.00 | 2,500.00 | 5,000.00 | 5,000.00 | 10,000.00 |
| 4 | 10.00 | 3,700.00 | 13.50 | 4,995.00 | 9.00 | 3,330.00 |
| 5 | 38.00 | 39,520.00 | 31.00 | 32,240.00 | 40.00 | 41,600.00 |
| 6 | 173.00 | 197,220.00 | 246.00 | 280,440.00 | 382.00 | 435,480.00 |
| 7 | 56.50 | 169,500.00 | 68.00 | 204,000.00 | 87.00 | 261,000.00 |
| 8 | 0.75 | 14,280.00 | 1.10 | 20,944.00 | 0.80 | 15,232.00 |
| 9 | 0.65 | 825.50 | 4.00 | 5,080.00 | 0.60 | 762.00 |
| 10 | 3.25 | 2,778.75 | 12.00 | 10,260.00 | 4.00 | 3,420.00 |
| 11 | 8.50 | 3,910.00 | 12.00 | 5,520.00 | 15.00 | 6,900.00 |
| TOTAL | | 499,734.25 | | 596,279.00 | | 821,224.00 |

but in other cases there are more bidders because the Caltrans adopts open bidding and the number of bidders are not restricted. The stored data can be sorted according to the item code, quantity of work, districts, year, etc. When the Caltrans wants to estimate a construction cost, they take out the unit prices of similar quantity, same district, same year, etc and utilize them to guess relevant unit prices. This system works well and can estimate a cost in a short time and with a few labors. When there is a quite new unit of work, which does not have former examples, engineers will take a quotation from contractors or brake down the work into already known items or analyze the work completely and estimate the cost just the same way as Japanese. As quite new works are rare, the Caltrans system can save the labors and the time considerably.

## 3. Cost Estimate System of UK and Germany

In UK, the government hires consultants to estimate the construction costs based on a data base system of former bidding unit prices. Unit prices are estimated by adjusting the data according to the commodity price index, the area of construction, etc.

In Germany, government in-house staffs estimate construction costs based on a similar data base system as Caltrans or UK. From the investigations. The unit works are precisely and strictly defined in Germany so that the unit prices can be repeatedly utilized, which is a same manner as the Caltrans.

## 4. Application to Projects in Developing Countries

It would be advantageous to apply this data base system to the Japanese ODA projects in developing countries because it takes shorter time to estimate with less labor, although the system is not almighty. To establish the data base system in each developing country, first it is necessary to define unit of works strictly and precisely with preferably standard plans, so that the unit price data can be repeatedly utilized. After the collection of data of a few years, the system begins to work well.

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