

---

## DATABASES FOR COSTS CALCULATION DEVELOPMENT

Mihaela URDEA

Transilvania University of Braşov, România

**Abstract.** This paper presents an overview of databases and provides an introduction to management and cost accounting, using databases. Another goal is to present a database related to bearings total costs. The plain bearings have a complex technology with a lot of calculations. The total costs suppose the material cost, the total manufacturing costs and the indirect costs. This work organizes the database of half – plain bearing with Al-Sn antifriction material. The half - plain bearings is manufacturing of bimetal strip. The plain bearings are manufactured to the standard level (ST) or for repairs R1,...R6, and there is a large database good for Access application.

**Keywords:** Material costs, manufacturing costs, period costs, databases, bearing.

### 1. Introduction and overview of databases

Computers can work with databases however large they may be, they are able to select and analyze data, do as many calculation necessary, generate models, prototypes, simulate operations, draw conclusions, etc [1].

Databases have a role decisive in the development of information systems. Data processing technique has evolved over the years, the main objective being access as quickly as possible, randomly, to the database. A database is a structured set of data entries called *records* consist of fields named *fields*. Records may be understood as lines of a table and fields as columns. The records have fixed length and are allocated space. When some fields are not filled with data they are filled with blanks or zeros by default. Each field can be numeric, character, logical, or calendar date.

The order of records is less important, managing database system contains the possibility of sorting and ordering records and information generally contained in the database.

Database applications can be regarded from two perspectives: one of user and that of designer. As regards of user application requires the data through interface elements and will get results on the screen, disk or printer.

As regards of the designer application is seen much more complex. Data, which operates the application, are stored in one or more databases, so, the application programs will be defined [2].

There is currently a trend towards centralized data storage in a so-called *Engineering Database*, respectively one common database.

Most organizations whose activities consist of a series of common or repetitive operations maintain their databases at standard, rather than actual costs, for both traditional and ABC systems. When a standard costing system is used the database is maintained at standard cost and actual output is costed at the standard cost.

### 2. Costs components

The cost components are: *production costs*, *product cost* and *period costs* [3].

#### 2.1. Production costs

Companies that manufacture a product face an expanded set of accounting issues. In addition to the usual accounting matters associated with selling and administrative activities, a manufacturer must deal with accounting concerns related to acquiring and processing raw materials into a finished product.

Cost accounting for this manufacturing process entails consideration of three key cost components that are necessary to produce finished goods:

- *Direct materials* include the costs of all materials that are an integral part of a finished product and that have a physical presence that is readily traced to that finished product. The cost of such items is termed "indirect materials." These indirect materials are included with other components of manufacturing overhead, which is discussed below.

- *Direct labour (manufacture costs)* costs consist of gross wages paid to those who physically and directly work on the goods being produced. The wages paid to a welder who is building an assembly line that will be used to produce a new line of

bicycles is not direct labour. In general, indirect labour pertains to wages of other factory employees (e.g., maintenance personnel, supervisors, guards, etc.) who do not work directly on a product. Indirect labour is rolled into manufacturing overhead.

- *Manufacturing overhead* includes all costs of manufacturing other than direct materials and direct labour. Examples include indirect materials, indirect labour, and factory related depreciation, repair, insurance, maintenance, utilities, property taxes, and so forth.

Factory overhead is also known as indirect manufacturing cost, burden, or other synonymous terms. Factory overhead is difficult to trace to specific finished units, but its cost is important and must be allocated to those units. Normally, this allocation is applied to ongoing production based on estimated allocation rates, with subsequent adjustment processes for over- or under-applied overhead.

Importantly, nonmanufacturing costs for selling and general/administrative purposes (SG&A) are not part of factory overhead. Selling costs related to order procurement and fulfilment, and include advertising, commissions, warehousing, and shipping. Administrative costs arise from general management of the business, including items like executive salaries, accounting departments, public and human relations.

Accountants sometimes use these relations:

$$\text{Prime Costs} = \text{Direct Labor} + \text{Direct Mate} \quad (1)$$

$$\text{Conversion Costs} = \text{Direct Labor} + \text{Manufacturing Overhead} \quad (2)$$

## 2.2. Product costs

Products result from the manufacturing process and product costs are the summation of direct materials, direct labour, and factory overhead. When inventory is purchased, it constitutes an asset on the balance sheet. This inventory remains as an asset until the goods are sold, at which point the inventory is gone, and the cost of the inventory is transferred to cost of goods sold on the income statement (to be matched with the revenue from the sale). What is important to note about product costs is that they attach to inventory and are thus said to be *inventorial costs*.

## 2.3. Period costs

Period costs are any costs that are not product costs. But, such a definition is a stretch, because it fails to consider expenditures that will be of benefit for many years, like the cost of acquiring land,

buildings, etc. One can say that product costs are the *inventorial manufacturing costs*, and period costs are the nonmanufacturing costs that should be expensed within the period incurred.

## 3. Database design for plain bearing costs

This section organizes the database of half – plain bearing with Al-Sn antifriction material (Figure 1).

Thin wall bearings are hydrodynamics slice bearing, with no more than 0.03 mm in thickness from the inner diameter of the bearing. They are made as a steel holder with antifriction material applied on it, or steel or antifriction alloy only.



Figure 1. Half-plain bearings

The materials used for to manufacture thin-wall plain bearings are: steel back OLC8X, antifriction material with aluminium base (AS20 - equivalent with AlSn20Cu - as ISO 4383:2000, AS6, AS6N1 - equivalent with AlSn6Cu - as ISO 4383:2000) and antifriction material with copper base (CP10S, CP10S10 - equivalent with CuPb10Sn10 - as ISO 4383:2000, CP23S2, CP22S4, CP26S2). The bimetal with Al-Sn antifriction material include in this case: a cold laminated and calibrated strip, an Al alloy strip (for plating) named also aluminium folium and an Al-Sn alloy strip.

The plain bearings are manufactured to the standard level (ST) or for repair R1- R6. The plain bearing symbol is given for the engine constructor.

For an easier management of the thin-wall plain bearings database, all the plain-bearings were renamed with a new symbol, a number of *six digits*. This symbol will define the type bearings, antifriction material, size of bearings and degree of wear.

Within new symbol, antifriction material gives the first character, as follows:

1 - AS20; 2 - AS6; 3 - CP10S10; 4 - CP23S2; 5 - CP22S4; 6 - CP26S2; 7 – Steel.

The second character comes from the type of bearings [2, 3]:

1. half-plain-bearings;
2. half-plain-bearings main bearing;
3. half inner bearing;
4. small end bushing;
5. cam shaft bushing;
6. rocker bushing.

Symbols designed specifically for database processing for production and costs is presented, for example: 13432ST, 13432R1 13432R2, 13432R3, 11100ST, 11100R1, 11100R2, 12101ST, 12101 R1, 12101R2, 12102ST, 12103ST, 12103R1, 12103R2, 12104ST, 21360ST, 21360R1, 21360R2, 21360R3, 21360R4, 21360R5, 21360R6.

For example the **MatCosts**, database necessary for materials costs; it proposes to organize in 4 files.

The database comprises as text files: AS.txt, AL.txt, CP.txt, Kgas.txt;

*CP.txt* – this file corresponds to the CP alloy in the antifriction layer; it contains 11 columns with values referring to the old symbol of the plain bearing, overall dimensions, semi finished product dimensions in the case of an CP alloy antifriction alloy (Figure 2);

*AS.txt* – file corresponding to AS20 and AS6 alloys in the antifriction layer. This file contains 13 columns with values referring to the old symbol of the plain bearing, its overall dimensions, semi finished product dimensions (Figure 3);

*Al.txt*- this file contains the percentages of metal in the Aluminium alloy to be found in the antifriction layer;

*Kgas.txt* - file connected to the presence of AS20 and AS6 alloys in the antifriction layer with reference to the semi finished product.

Text-type files could be visualized by using a text editor and they could eventual be modified. Below, few lines in the *AS.txt* file are presented. In the first and last lines the new and old symbol of the component can be noticed. As for the rest, columns defining basic dimensions are presented (Figure 3).

These files can be imported into Access or Excel to process the dates or can be read in programs like C++ or Delphi.

#### 4. Total costs for plain-bearings

Organization of a database involves defining the correct calculation formulas in order to know all the input data.

In order to generate the databases for plain bearings for the total plain bearings costs is necessary to define the follow annotations.

- Consumption of cold laminated strip (Nc1), respectively calibrated (Nc2);

Symbol	Material	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
47113	ST	0.8	300	75	1.01	0.3	8529488			
47114	ST	0.8	350	110	1.04	0.34	8575569			
43115	ST	0.8	300	70	0.94	0.3	8528395			
43116	ST	1.25	300	74	1.64	0.42	8529525			
49365	ST	1.75	250	120	2.2	0.65	5371810050			
34375	ST	1.75	350	115	2.16	0.65	8370380950			
45376	ST	2.0	350	115	2.35	0.65	1712C0303			
49380	ST	1.75	400	100	2.2	0.65	5371810150			
45381	ST	2.0	400	100	2.35	0.65	5500511710			
41188	ST	1.25	350	68	1.35	0.45	89541210001			
45189	ST	2.25	350	115	2.7	0.6	51044100045			
46190	ST	0.8	400	89	1.2	0.45	51930200008			
46191	ST	0.8	400	89	1.2	0.45	51930201020			
47193	ST	1.25	350	115	1.75	0.5	89930010020			
44194	ST	2.25	300	145	2.8	0.7	89024050003			

Figure 2. CP.txt file

Symbol	Material	V1	V2	De	L	Gcu2	GlC	L1	GlR	Lb	Gal	Gb	G1	S1
11100	ST	47.625	17.75	1.927	4.0	350	2.40	110	1.06	1.95	1.4	7700501171		
11100	R1	47.625	17.75	1.927	4.0	350	2.40	110	1.02	2.05	1.5	7700501171		
11100	R2	47.625	17.75	1.927	4.0	350	2.40	110	1.02	2.05	1.65	6000543660		
12101	ST	49.89	19.5	1.921	4.0	250	2.50	110	1.02	2.05	1.5	7700536411		
12101	R1	49.89	19.5	1.921	4.0	250	2.50	110	1.02	2.05	1.65	7700545719		
12101	R2	49.89	19.5	1.921	4.0	250	2.50	110	1.02	2.05	1.75	6000543638		
12102	ST	49.89	19.5	1.921	4.0	250	2.50	110	1.02	2.05	1.5	7700536412		
12103	ST	49.89	19.5	1.921	4.0	250	2.50	110	1.02	2.05	1.5	7700536415		
12103	R1	49.89	19.5	1.921	4.0	250	2.50	110	1.02	2.05	1.65	7700545817		
12103	R2	49.89	19.5	1.921	4.0	250	2.50	110	1.02	2.05	1.75	6000543634		
12104	ST	49.89	19.5	1.921	4.0	250	2.50	110	1.02	2.05	1.5	7700536416		
11119	ST	51.625	17.75	1.802	4.0	350	2.4	110	0.92	1.95	1.45	6000543193		
21360	ST	136.799	49	2.835	6.0	300	3.9	140	1.39	3.1	2.35	M12F050601		
21360	R1	136.799	49	2.835	6.0	300	3.9	140	1.67	3.25	2.35	M12F050601		
21360	R2	136.799	49	2.835	6.0	300	4.3	140	1.48	3.4	2.6	M12F050601		
21360	R3	136.799	49	2.835	6.0	300	4.3	140	1.67	3.5	2.6	M12F050601		
21360	R4	136.799	49	2.835	6.0	300	4.6	140	1.57	3.6	2.75	M12F050601		
21360	R5	136.799	49	2.835	6.0	300	4.6	140	1.76	3.7	2.75	M12F050601		
21360	R6	136.799	49	2.835	6.0	300	5.0	140	1.67	3.9	3.0	M12F050601		
22361	ST	160.065	55	5.471	14	80	9.0	80	1.30	5.9	5.2	M12F050603		
22361	R2	160.065	55	5.471	14	80	9.0	80	1.48	6.2	5.4	M12B040203		
16273	T	20.94	19.65	1.84	3.0	400	2.0	90	1.11	1.73	1.15	11302162		
12252	ST	85.00	46.0	2.5	5.5	370	3.3	170	1.20	2.65	2.0	10301261		

Figure 3. AS.txt file

- Amount of recoverable steel wastes (D3) and aluminum wastes (D5) in the aluminum foil;
- Aluminum foils consumption (CfAl);
- Antifriction alloy consumption (Nc6);
- Amount of alloy waste recovered in the process of bimetal strip manufacturing (D7);
- Bimetal strip consumption (Nc8);
- Alloy consumption on primary elements (CA1, CSn, Ccu, Cni);
- Consumption of direct supplying materials required for manufacturing plain bearings (CAAL, CASn, CACu, CAPb);
- Amount of linear meters required to achieve 1000 pieces of plain bearing (Nml);
- Steel mass (M1) and alloy mass in plain bearing (M1);
- Unitary prices for direct materials;
- Material costs for steel, laminated and calibrated strip (CostOtelB1, CostOtelBc);
- Material costs for aluminum foil and block, (CostCfAl, CostCA1);
- Material costs for antifriction material Sn, Cu, Pb and Ni, (CostCSn, CostCCu, CostCPb, CostCni).

#### 4.1. Calculus of total material costs (Tcost)

The following relation gives the calculus of the total material costs (Tcost) [4]:

$$Tcost = CostOtelBl + CostOtelBc + CostCfAl + CostCAL + CostCSn + CostCCu + CostCPb + CostCNI \quad (3)$$

For example the relations for the component 12252 could have the following forms:

$$CostOtelBc=32,43Nc1.Nml \quad (4)$$

$$CostOtelBl=33,8Nc2.Nml \quad (5)$$

$$CostCAL=67,86CAL \quad (6)$$

$$CostCfAl=153,74CfAl \quad (7)$$

$$CostCSn=236,5CSn \quad (8)$$

#### 4.2. Calculus of manufacture costs (CprelTot)

The calculus of the manufacture cost includes:

Total manufacturing costs of the bimetal strip (Cmanbm), contains:

- the consuming of manual labour which depend of worker category, category from 3 to 6 (CostTariff);
- manual labour costs which depend on the type of the blanks (of the bimetal strip).

The bimetal strip costs (CostBbm), include:

- the cold laminated strip manufacturing costs (CostBlr);
- the aluminum folium manufacturing costs (CostfAl);
- the Al-Sn alloy strip manufacturing costs (CostAl-Sn).

Result the followings formulas:

$$CostBbm = CostBlr + CostfAl + CostAl-Sn \quad (9)$$

$$Cmanbm = CostBbm + CostTariff$$

The blank size is give for the half – plain bearing type and is defined by ml/1000 piece or Kg/1000 piece.

Total manufacturing costs of the mechanic process (prelTot), include:

- Costs of pressing, face turning, cut of wall pressing, cut of wall pressing + hole boring, hole boring, window cutting, lateral window cutting, inside counter boring, outside counter boring, cutting lubrication canal, lubrication canal turning, brushing, face broaching, inside broaching, washing, degreasing, depth sorting. 100%, galvanizing, aspect sorting, final control, final conservation, packaging, labelling.
- Cost of worker tariff (Cost W).

The total manufacturing costs is given by the formula:

$$Ctotman = CprelTot + Cmanbm \quad (10)$$

Table 1 is, for example, an Excel capture and represents a part of the calculus for manufacture cost, with worker category. They are 6 categories, for three-activity code. The values are only informative.

#### 4.3. Calculus of other costs (Manufacturing overhead)

The calculations of other costs, which are not included in total manufacturing costs or total materiel costs, are presented in formulas bellow. Total materiel costs calculation, necessary for calculus of other costs (Cmatdir):

$$Cmatdir = TCost + Ctotman \quad (11)$$

Table 1. Worker category

Tariff	Time	Worker category (Ron)					
		1	2	3	4	5	6
Founry code 01	min				8.670	8.750	9.270
Heat treatment Code 15	min	4.87	5.950	6.050	6.870	6.750	7.37
Mechanic process Code 04	min	4.56	5.640	5.250	6.050	6.370	7.850

The indirect costs include:

Costs of health (CCAS), social insurance costs calculation (CCAS), costs of tools, device, control (CSDV), marketing and advertising costs calculation (CPubl), costs of CF (CCF), costs of CCI (CCI), and insurance costs calculation (CAs).

The relations between components, promoted informative to RomLagSA have the following form:

$$CIs = 0,10(Cmatdir + CCAS + CSDV) \quad (12)$$

$$CCAS = 0,35Ctotman \quad (13)$$

$$CCAS = 0,35Ctotman \quad (14)$$

$$CSDV = 0,45Ctotman \quad (15)$$

$$CPubl = 0,04(Cmatdir + CCAS + CSDV) \quad (16)$$

$$CCCF = 3,5(Ctotman + CCAS) \quad (17)$$

$$CCI = 0,25(Cmatdir + CCAS + CSDV) \quad (18)$$

The following relations give the calculus of the total costs of other costs (symbol CA):

$$CA = CCAS + CSDV + CCCF + CCI + CPubl + CAs \quad (19)$$

#### 4.4. Calculus of total cost (CTOT)

The total cost includes all the costs. The following relations give the calculus of the total costs (symbol CTOT):

$$CTOT = Cmatdir + CA \quad (20)$$

#### 4.5. Calculus of fabrication cost (FCOST)

The fabrication cost is the total cost with the benefit added. The benefit depends on the company, it is added only a symbolic value.

$$Benefits = 12\% CTOT \quad (21)$$

$$FCOST = CTOT + 12\% CTOT \quad (22)$$

Total costs can be processed in Excel or Access applications or complex programs can be used, like C++ or Delphi.

## 5. Developing Costs database using Access Application

Access application is used to organize Costs database. To create the tables in Costs plain bearing database, every line table begin with bearing symbol. For example, the groups of tables in Access application as figure 4, has been generated.

ID	Symb	Rε	Tř	Wl	Dl	Wic
1	13432	ST	3.00	170	2.50	170.00
2	13432	R1	3.00	170	2.50	170.00
3	13432	R2	3.00	170	2.50	170.00
4	13432	R3	3.00	170	2.50	170.00
5	12431	ST	4.00	170	3.00	170.00
6	12431	R1	4.00	170	3.00	170.00
7	12431	R2	4.00	170	3.00	170.00
8	12431	R3	4.00	170	3.00	170.00
9	12431	R4	4.00	170	3.00	170.00

Figure 4. The Table Bearing

Figure 4 include the following table: *Bearing*, Department, Foil Al-Sn, Manufacture costs, Lot recoverable, Other costs, Symbol bearing, Total costs. These tables relates to the costs presented in paragraph 4. They will use to the total cost (TCOST) calculations.

### 5.1. Bearing table

*Bearing* table is the largest table with all the data bearings for half-plain bearings, special for Al-Sn antifriction material. Figure 5 is a capture from Bearing design view. This Bearing table refers to **MatCosts** databases necessary for materials costs.

*Bearing* table in Datasheet view has the capture below (Figure 6). Table Bearing is very large corresponding to AS20 and AS6 alloys in the antifriction layer.

Field Name	Data Type	Notes
ID	AutoNumber	
Symbol V1	Text	symbol for bearing
Reparation V2	Text	raparation quota
Thickness band lam Warm G1c	Number	
With band lam L	Number	
Depth band lam cold G1r	Number	
Width band bimetal Lb	Number	
Thickness alloy Al Gal	Number	
Thickness band bimetal Gb	Number	
Thickness steel G1	Number	
Diam seat Dloc	Number	
Diam ext De	Number	
Width bearing L	Number	
Dev high width bearing AsL	Number	
Dev lower width bearing AiL	Number	
Thickness bearing Gcuz	Number	
Dev high depth steel AsG1	Number	
Dev lower depth steel AiG1	Number	
Stress P	Number	
Old Symbol S1	Number	

Figure 5. The bearing table in design view

ID	Symb	Rε	Tř	Wl	Dl	Wic	...	S
1	13432	ST	3.00	170	2.50	170.00	...	0
2	13432	R1	3.00	170	2.50	170.00	...	0
3	13432	R2	3.00	170	2.50	170.00	...	0
4	13432	R3	3.00	170	2.50	170.00	...	0
5	12431	ST	4.00	170	3.00	170.00	...	660
6	12431	R1	4.00	170	3.00	170.00	...	660
7	12431	R2	4.00	170	3.00	170.00	...	730
8	12431	R3	4.00	170	3.00	170.00	...	765
9	12431	R4	4.00	170	3.00	170.00	...	800

Figure 6. The bearing table (Datasheet view)

Microsoft Access applies the Bearing table for creating a Form named Bearing Form. The Bearing Form is presented in the next capture (figure 7).

Figure 7. The Bearing form

## 6. Conclusions

This paper presents an original design processing for bearings. In this direction it proposes a reorganization of plain-bearing symbols according to their utility. This rename, new symbol, will simplify the processing of data in tables. The new symbolization is especially beneficial to calculate the cost of materials but not only.

This work is an own design method by using Access for plain bearing databases. It refers only to the application *Bearing*, necessary to *Direct Materials Costs*. This work can be extended to generate the Access database for all presented costs.

## References

- Zamfir, N. (2000) *Bază de date destinată proiectării tehnologice asistate de calculator (Database for computer aided technological design)*. Ph.D. thesis. Transilvania University of Braşov, Romania, 2000 (in Romanian)
- Drury, C. (2008) *Management and cost accounting*. British Library Cataloguing in Publication Data, Publisher Nelson Edition Ltd, ISBN: 978-1-84480-566-2, London, England
- \*\*\* *Principles of Accounting*. Available from: [www.principlesofaccounting.com/Default.htm](http://www.principlesofaccounting.com/Default.htm) Accessed: 11/07/2011
- \*\*\* *Product Catalog*. RomLag SA, Available from: [www.romlag.com/attachments/article/48/catalog%20romla%20-%20202011.pdf](http://www.romlag.com/attachments/article/48/catalog%20romla%20-%20202011.pdf), Accessed: 5/05/2010