

Life Cycle Costing Spreadsheet Instructions

LCC Spreadsheet Introduction

The following worksheet has been compiled to help users determine the Life Cycle Costs for particular material handling investments. The spreadsheet can be used to compare potential investments, determine the driving cost in complete system investments or aid in the budgeting of necessary capital for such investments.

There are three main worksheets to the LCC spreadsheet; the Front Sheet, the SystemType Sheet(s), and the Default Page Sheet. The Front Sheet is the summary sheet that provides the user with a quick look at the three main costs per each SystemType that is costed out. The three main costs displayed are the Total Life Cycle Cost, the Total of the Initial Costs, and the Net Present Value (NPV) of the Annual Costs over the Project Lifetime.

The SystemType Sheet(s) is specific to the System the user is costing out on that particular page. It is on this page the user is able to enter in the values (or rely on default values) to calculate the desired costs displayed on the Front Sheet. This sheet has three main sections to it. The first section (top) allows the user to determine the type of system to be costed out. The second section (middle) enables the user to assign quantities to certain aspects of the life cycle cost. Each aspect is assigned an ID and has a simple definition in this section to help the user understand the value they are assigning. The last section (bottom) is where all of the calculation of quantities is done via pre-determined equations.

The Default Page Sheet is where each ID aspect is assigned a pre-determined default value in case the user is unable to provide a specific value for that particular aspect.

Front Sheet Worksheet

The Front Sheet is where the user can **determine the number of systems to be costed out** and is **displayed in the total cost chart below**. The total cost chart consists of four columns; SystemType, Total Life Cycle Cost, Total of Initial Cost and NPV of Sum of the Annual Costs over Project Lifetime. This chart will display *only* the first number of systems equivalent to the value entered into the question prompt.

D1U * =IF((\$E\$4>2),LCC Spreadsheet5 1U U4.xls\LCC3,"")					
A	B	C	D	E	F
1	Total Cost Form				
2					
3					
4	How many SystemTypes are being costed out? _____				3
5					
6					
7	SystemType	Total Life Cycle Cost	Total of Initial Cost	NPV of Sum of the Annual Costs over Project Lifetime	
8	Conveyor - Package	\$ 3,468,484.05	\$ 2,067,402.00	\$ 1,401,082.05	
9	Conveyor - Package	\$ 3,377,589.58	\$ 2,069,549.61	\$ 1,308,039.97	
10	Conveyor - Package	\$ 3,280,795.48	\$ 2,065,236.56	\$ 1,215,558.92	
11					
12					
13	Sum:	\$ 10,126,869.11	\$ 6,202,188.17	\$ 3,924,680.95	
14					

The only information the user needs to input into the Front Sheet is the **number of systems being costed out**.

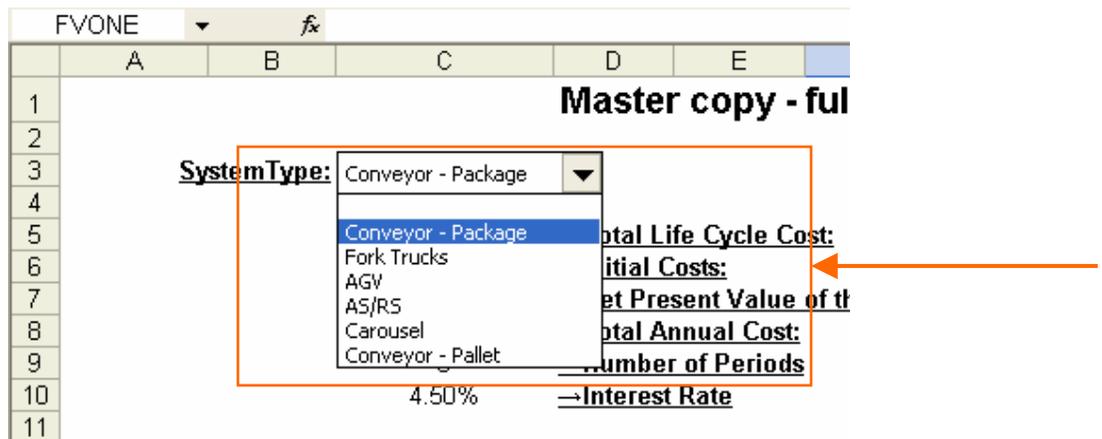
The Front Sheet can be used for two different purposes. The first use is to compare the costs between two or more of the same system type. For example, **the user can compare three different vendors supplying Conveyors - Packages and through using the Front Sheet make a decision of which vendor would be most cost effective**.

The second use is to analyze the cost of a complete system comprising different system types within the user's particular company. In this case, the Front Sheet would list the different system types in a user's complete system.

SystemType Sheet Worksheet

Each SystemType Page is specific only to the details of the system chosen for that particular page (e.g. conveyor - package, fork truck, etc.) This worksheet is where the necessary values specific to a system can be entered by the user to aid in the calculation of the Total Life Cycle Cost, Initial Costs and Annual Costs.

At the top of the sheet, the user can **select the type of System to be costed out** on that particular page **via a drop-down menu**.



Once the type of system that will be costed out on the page is chosen, the user can begin to **enter values into the Input Data Area**. Every value entered into the Input Data Area will be used to calculate **the values at the top of every SystemType Sheet**. These values are the **Total Life Cycle Cost, Initial Costs, Net Present Value of the Sum of the Annual Costs over Project's Lifetime, Total Annual Cost, Number of Periods and the Interest Rate**.

5									
6		\$	3,468,484.05	--Total Life Cycle Cost:					
7		\$	2,067,402.00	--Initial Costs:					
8		\$	1,401,082.05	--Net Present Value of the Sum of the Annual Costs					
9		\$	271,639.53	--Total Annual Cost: over Project's Lifetime					
10			6	--Number of Periods					
11			4.50%	--Interest Rate					
12	INPUT DATA AREA			IDDS	VALUES	DEFAULT	Equivalent Annual Cost	Present Value	
13	Purchaser Data								
16	Manhour cost M&O personnel			CH		40	42.45	218.95	
17	Manhour cost - "x" units handling			CH"x"		30	31.84	164.21	
20	Manager manhour cost per hour			CMGH		5			
21	Wage growth factor			WF		2.5%			
22	Number of manager hours per year			MGH		1			
23	Number of operational hours per year			YOH		2080			
24	Cost per Kwhour			CKW		0.14			
25	Additional time per workshop repair			ATM		1			
26	Additional time per system repair			ATS		1			
27	Additional time for system preventive maint..			ATP		1			
28	Start up cost factor			SUCF		75%			

In the Input Data Area, each ID is given a basic definition and an assigned value entered by the user (see Appendix 1 for further explanation of certain IDs). In order to receive values at the top of the SystemType Page, **there are four IDs the user is required to assign values for**. These IDs are NBX, CISB1, NMO and HTBR(x).

For a user to obtain unique cost calculations on a SystemType Page, it is recommended that at least 12 – 20 values (including the four required IDs) are assigned by the user.

The assigned value the user gives to an ID is unique only to that particular SystemType page. Each cell has been ‘defined’ accordingly to the SystemType page it is on. For example, the cell on SystemType 1 page for CH, the ID for Manhour Cost M&O Personnel, is defined as CHONE. This is important if the user decides to change the calculation equations below.

	A	B	C	D	E	F
12	INPUT DATA AREA			IDDS	VALUES	
13	Purchaser Data					
16	Manhour cost M&O personnel			CH		
17	Manhour cost - "x" units handling			CH"x"		
20	Manager manhour cost per hour			CMGH		
21	Wage growth factor			WF		
22	Number of manager hours per year			MGH		
23	Number of operational hours per year			YOH		
24	Cost per Kwhour			CKW		
25	Additional time per workshop repair			ATM		
26	Additional time per system repair			ATS		
27	Additional time for system preventive maint			ATP		

If the user desires to know what a particular cell is labeled as, they can look at the **top left of the spreadsheet**, which gives the name of the particular cell the user is on.

	A	B	C	D	E	F
12	INPUT DATA AREA				IDDS	VALUES
13						
14	Purchaser Data					
15						
16	Manhour cost M&O personnel				CH	
17	Manhour cost - "x" units handling				CH"x"	
18						
19						
20	Manager manhour cost per hour				CMGH	
21	Wage growth factor				WF	0.5%
22	Number of manager hours per year				MGH	
23	Number of operational hours per year				YOH	
24	Cost per Kwhour				CKW	
25	Additional time per workshop repair				ATM	
26	Additional time per system repair				ATS	
27	Additional time for system preventive maint..				ATP	
28	Start up cost factor				SUCF	

Some of the IDs within the spreadsheet are annual costs that have growth factors associated with them. In order to accurately take the growth factors (wage factors, equipment growth, etc.) into account, these ID values are recalculated to determine the Equivalent Annual Cost. The EAC is the number used in the calculations in the bottom section of the document.

For example, the user has entered the value 47 “CH” ID in the picture below. Since the “CH” ID has a growth factor associated with it, the Equivalent Annual Cost must be calculated and used in the calculations in the bottom section. In this particular example, the “CH” value increases from 47 to 47.58 with the 0.5% wage growth factor.

	A	B	C	D	E	F	G	H	I
12	INPUT DATA AREA				IDDS	VALUES	DEFAULT	Equivalent Annual Cost	Present Value
13									
14	Purchaser Data								
15									
16	Manhour cost M&O personnel				CH	47	40	47.58	245.31
17	Manhour cost - "x" units handling				CH"x"		30	30.36	15.58
18									
19									
20	Manager manhour cost per hour				CMGH		5		
21	Wage growth factor				WF	0.5%	2.5%		
22	Number of manager hours per year				MGH		1		
23	Number of operational hours per year				YOH		2080		
24	Cost per Kwhour				CKW		0.14		
25	Additional time per workshop repair				ATM		1		
26	Additional time per system repair				ATS		1		

The bottom section (in grey) of the SystemType Sheet is where the calculations are conducted using predetermined equations and the values the user assigned to each ID.

There exist four levels of the bottom section. The levels work in an upside-down pyramid fashion, where the calculations in the top level (level 4) are called upon by subsequent levels and so forth, eventually leading to the final calculations in the bottom level (level 1).

Each calculation is detailed to show the user what equation/factors were used to determine the particular answer. For example, when calculating the Investment in Training (ID is CIMT), it can be seen that the **two factors used in the calculation are the Number of Students Per Course (NUS) and Cost Per Students and Course (CST)**. Both values for the NUS and CST are called from the area where the user assigned values to each ID.

	A	B	C	D	E	F
93	4. Fourth Level Equations, (as needed)					
94						
95	4.1, Investment in training					
96						
97		CIMT	\$ 100.00	→NUS*CST		
98		Where				
99		NUS		1	→Number of students per course	
100		CST	\$	100.00	→Cost per students and course	

The **equations** used to calculate certain values, such as the CIMT, can be seen at the top of the page when the 'answer' cell is highlighted or right next to the 'answer' cell.

	A	B	C	D	E	F
93	4. Fourth Level Equations, (as needed)					
94						
95	4.1, Investment in training					
96						
97		CIMT	\$ 100.00	→NUS*CST		
98		Where				
99		NUS		1	→Number of students per course	
100		CST	\$	100.00	→Cost per students and course	

If the user wishes to change a value for a particular ID, a **link to the cell where the assigned value was entered** can be found in the calculation section. Since many IDs are used multiple times throughout the calculation section, there is no returning link.

	A	B	C	D	E	F
93	4. Fourth Level Equations, (as needed)					
94						
95	4.1, Investment in training					
96						
97		CIMT	\$	100.00	→NUS*CST	
98		Where				
99		NUS		1	→Number of students per course	
100		CST	\$	100.00	→Cost per students and course	

It is also important to note here that the value assigned to a particular ID in Section 2 is the value that will be used throughout the spreadsheet. If the user wants to choose whether or not they prefer to use the default values rather than the assigned values, they should not enter a value in at the input section. By not inputting a value, the spreadsheet will automatically use the default value instead.

The user can see which aspects are using default values and which are using input values through a color specification. When the user does not enter a value into the input section, the cell will be filled GREEN. GREEN cells denote that the default value is being used in the calculations. If the user enters any value, including 0, the cell will be filled YELLOW and that value will be used in the calculations rather than the default value. **IT IS IMPORTANT THAT IF THE INPUT IS NOT APPLICABLE THE USER ENTER "0"**.

	A	B	C	D	E	F	G	H	I
12	INPUT DATA AREA				IDDS	VALUES	DEFAULT	Equivalent Annual Cost	Present Value
13									
14	Purchaser Data								
15									
16	Manhour cost M&O personnel			CH	47	40	47.56	245.31	
17	Manhour cost - "x" units handling			CH"x"		30	30.36	156.58	
18									
19									
20	Manager manhour cost per hour			CMGH		5			
21	Wage growth factor			WF	0.5%	2.5%			
22	Number of manager hours per year			MGH		1			
23	Number of operational hours per year			YOH		2080			
24	Cost per Kw/hour			CKW		0.14			
25	Additional time per workshop repair			ATM		1			
26	Additional time per system repair			ATS		1			

Each SystemType Sheet has a similar layout and should be treated specifically to the particular system of that page. Each ID value will be unique to that particular page as well, since each system has different numerical characteristics.

Default Page Worksheet

The Default Page Worksheet is where predetermined values for the IDs have been assigned. These default values will be used only if the user does not assign an ID a certain value. The default values may be different between pages depending on the type of Systems that are being costed out on each page.

The default values will appear on each SystemType page and will be dependent on the type of System the user chooses at the top of each page.

The screenshot shows a spreadsheet interface with a dropdown menu for 'SystemType' and a table of input data. The dropdown menu is open, showing options: Conveyor - Package, Fork Trucks, AGV, AS/RS, Carousel, and Conveyor - Pallet. The table below has columns for IDDS, VALUES, DEFAULT, Equivalent Annual Cost, and Present Value. The 'VALUES' column has a blue background, 'DEFAULT' has a light blue background, 'Equivalent Annual Cost' has an orange background, and 'Present Value' has a light green background. A blue circle highlights the dropdown menu and the 'VALUES' column. A blue arrow points from the 'VALUES' column to the 'Equivalent Annual Cost' column.

INPUT DATA AREA	IDDS	VALUES	DEFAULT	Equivalent Annual Cost	Present Value
Purchaser Data					
Manhour cost M&O personnel	CH	47	40	47.56	245.31
Manhour cost - "x" units handling	CH"x"		30	30.36	156.58
Manager manhour cost per hour	CMGH		5		
Wage growth factor	WF	0.5%	2.5%		
Number of manager hours per year	MGH		1		
Number of operational hours per year	YOH		2080		
Cost per Kwhour	CKW		0.14		
Additional time per workshop repair	ATM		1		
Additional time per system repair	ATS		1		
Additional time for system preventive maint..	ATP		1		
Start up cost factor	SUCF		75%		

Again, it is required that the user assign values to the following four IDs. It is recommended in order to make each SystemType Page unique, that between 12 and 20 values are assigned.

One thing is important to note though. The user can rely on using a majority of default values when making a relative comparison between two system types. Although the absolute costs are not identified, the defaults will provide a good enough comparison as long as 12 to 20 IDs are assigned values by the user.

Conclusion In conclusion, the Life Cycle Costing Spreadsheet can be used for two purposes. One purpose is for the user to compare 2 or more of the same system type. The second purpose is for the user to analyze the cost of their complete system of system types.

Appendix 1
Variable
Definitions

CH"x" This refers to the man-hour costs for handling "x" units. If there are other units handled where the man hour costs are different than the "x" units, then line 17 should be used for "x" units and 18 use for "y" units. Likewise line 70 is for "x" units and line 71 should be used for "y" units if their time is different than "x" units. If the man hour costs are the same, then only line 18 and 71 need be used if the time for "y" units.

WF Wage growth factor. This factor is the amount by which wages will grow each year. It should be entered as a percentage (e.g. .025 for a 2.5% increase each year.)

ATM Additional time per workshop repair. This represents additional time that must be spent for each item that must be worked on in the workshop for preventive maintenance or repair.

ATS This represents additional time that will be required for system repair. That is, time in addition to what is spent doing the actual maintenance actions. For example, the time to set up software or equipment necessary to shorten the corrective maintenance time to reduce down time.

ATP This represents additional time that will be required for system preventive maintenance. That is, time in addition to what is spent doing the actual preventive maintenance actions. For example, the time to set up software or equipment necessary to shorten the preventive maintenance time.

SUCF Start up cost factor. This is a percentage of the system maintenance cost that represents additional costs associated with starting the system up initially. For example, you will probably have more maintenance personnel on-hand the first time you start things up in the event that there are problems with the system.

ZWM Failure rate for items that will be repaired at workshop. This represents how frequently items that get repaired in the workshop will fail. It should be expressed as the rate per hour the system is operating. For example, if you expect an item to have a probability of one in one thousand of failing once per hour then a value of 0.001 would be input for ZWM.

ZWS Failure rate for the system. This represents how frequently the system will fail. It should be expressed as the rate per hour the system is operating. For example, if you expect the system to have a probability of one in one thousand of failing once per hour then a value of 0.001 would be input for ZWS.

WLS This is the average workload or basic time required per system repair for the repair itself.

ZWR Failure rate for discardables. This represents how frequently the discardables in the system will fail. It should be expressed as the rate per hour the system is operating. For example, if you expect the discardables in the system to have a probability of one in one thousand of failing once per hour then a value of 0.001 would be input for ZWR.

CARE Average discardable cost per repair. Every time a discardable fails, this is the average cost per replacement. Discardables are items that wear out like DC motor brushes, hoisting ropes, brake shoes, etc., this cost is the sum of the part and the time to replace it.