CHAPTER 3

CURRENT SYSTEM ANALYSIS

This chapter describes about the current process to detect the machine error in the company. The data of detection have been recorded and used for other analysis such as machine utilisation, machine capacity, number of required machine for production.

First section is procedure to detect and record the status and error of the machine. Later sections contain using this information for analysis. The last section describes the problems that the company encounter on this process.

3.1 Machine down time record

All die attach machines do not interface to any host computer or other system now. It is the stand-alone system. Thus, the procedure of machine down time record is used to detect the machine state and its error. These informations have been recorded in the down time card manually by either operator or technician.

Operators and technicians are assigned to operate the machine and record the equipment error onto down time card. The information on the down time card includes Date, Status / Problem, Time of start, Time of finish, etc. They record every information manually. Figure 3.1 shows the format of down time card that is used by the company.

REFER TO: SP-DOC-031
SERIAL: 03

M/C TYPE:_____
M/C NO. :_____

MACHINE DOWN TIME REPORT

DATE	SHIFT	PT NUMBER	STATUS / PROBLEM	TIME START	TIME FINISH	TOTAL D/T	TOTAL R/T	ACTIONS	E/N

Note: D/T = Down time R/T = Repair time E/N = Employee Number

Figure 3.1: Standard format of down time card in the company

The purposes of down time card are to record the status and errors of the machine. Every item of machine activities such as machine state transition and error detection shall be recorded on the card. The information on down time card shall be used for the other analysis. Hence, accuracy and reliability of the information on down time card is very important and useful.

3.2 Machine utilisation

The information on down time card shall be analysed initially in this step. All records of machine activities and error types are classified and grouped. A report is generated to calculate the machine utilisation. Information in this report includes machine down time, machine up time, machine utilisation, description of each activities related to down time, etc. The following is example of the machine utilisation report on all ESEC die attach machines during September 05th-11th, 1999.

UTILISATION REPORT

MACHINE : ESEC LINE : D/A

PAGE : 1

PLASTIC OPERATIONS DEPARTMENT FROM WW : 36 TO 36 (Sep 05,99 – Sep 11,99)

ASSY MAINTENANCE SECTION TOTAL M/C : 15

ITEM	PROBLEM	D/T TTL.	R/T TTL.	W/T TTL.	F/D TTL.	MTBF	MTTR	% D/T TTL.	%R/T TTL.
* 1	PROCESS TIME	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
* 2	QUAL LOT TIME	4.39	0.00	0.00	1	1953.54	0.00	0.18	0.00
* 3	EQUIPMENT TIME	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
* 4	MATERIAL SHORT	46.00	0.00	0.00	40	48.84	0.00	1.90	0.00
* 5	PREVENTIVE MAINTENANCE	3.83	3.83	0.00	10	195.35	0.38	0.16	0.16
6	OTHERS	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
7	JAM	13.74	12.3	1.44	25	78.14	0.49	0.57	0.51
* 8	SUPPLY FAULTY	3.35	0.00	0.00	6	325.59	0.00	0.14	0.00
* 9	CHANGE LEAD TYPE	38.57	31.95	6.63	25	78.14	1.28	1.60	1.32
*10	FUNCTIONAL TEST	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
*11	CHANGE DEVICE	84.41	59.74	24.68	94	20.78	0.64	3.50	2.47
*12	EPOXY EXPIRE (CHANGE EPOXY)	85.79	57.84	27.95	171	11.42	0.34	3.55	2.39
13	INDEX PROBLEM	3.75	3.27	0.48	8	244.19	0.41	0.16	0.14
14	INPUT FRAME PROBLEM	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
15	O/P FRAME PROBLEM	4.07	3.91	0.16	8	244.19	0.49	0.17	0.16
16	EPOXY ON LEAD	0.48	0.48	0.00	1	1953.54	0.48	0.02	0.02
17	EPOXY ON DIE	0.40	0.24	0.16	1	1953.54	0.24	0.02	0.01
18	FRAME OFF	5.03	4.15	0.88	2	976.77	2.08	0.21	0.17
19	STACK LOAD PROBLEM	1.92	1.52	0.40	7	279.08	0.22	0.08	0.06
20	NON PICK UP DIE	8.87	5.27	3.59	15	130.24	0.35	0.37	0.22

Remark: * = This item is not M/C down time (Not cal in % M/C uptime)

D/T = DOWNTIME R/T = REPAIR TIME W/T = WAITING TIME

F/D = FREQUENCY DOWN MTTR = MEAN TIME TO REPAIT TIME MTBF = MEAN TIME BETWEEN FAILURE

% D/T = (TTL D/T / AVAILABLE HOURS) X 100 M/C UPTIME= AVAIL – TTL (M/C DOWNTIME)

UTILISATION = M/C UPTIME - (PE,CAL,MAT'L) TTL AVAILABLE = TTL. M/C x DAY x SHIFT x HRS

Continue on page: 2

UTILISATION REPORT

MACHINE : ESEC LINE : D/A

PAGE : 2

PLASTIC OPERATIONS DEPARTMENT FROM WW : 36 TO 36 (Sep 05,99 – Sep 11,99)

ASSY MAINTENANCE SECTION TOTAL M/C : 15

	ITEM PEOBLEM	D/T TTL.	R/T TTL.	W/T TTL.	F/D TTL.	MTBF	MTTR	% D/T TTL.	%R/T TTL.
21	PICK UP INK DIE	2.32	0.88	1.44	4	488.38	0.22	0.10	0.04
22	TAPE UNDER DIE	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
23	SKIP GOOD DIE	19.81	14.77	5.03	49	39.87	0.30	0.82	0.61
24	DIE PLACEMENT	37.38	29.71	7.67	51	38.30	0.58	1.55	1.23
25	DIE DROP OFF RPOBLEM	1.36	0.96	0.40	3	651.18	0.32	0.06	0.04
26	INSUFFICIENT POLY	29.15	18.45	10.70	63	31.01	0.29	1.21	0.76
*27	SETUP&B/O BONDLINE THICKNESS	4.23	3.03	1.20	10	195.35	0.30	0.18	0.13
*28	WAITING FOR B/O EPOXY VOID	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
*29	CHANGE CODE, MARKING TOOLS	62.61	43.78	18.83	88	22.20	0.5	2.59	1.81
31	M/C DOWN	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
	Total M/C Downtime	128.26 Hrs.		5.31%					
	TTL.	461.46	296.08	111.63	682	2.86	0.43	19.11	12.26

AVAILABLE HORS : 2415

TOTAL UTILISATION : 1954

%UTILISATION : 80.89

%M/C UPTIME : 94.69

TOTAL WORK-DAY = 7 DAY

Remark: * = This item is not M/C down time (Not cal in % M/C uptime)

D/T = DOWNTIME R/T = REPAIR TIME W/T = WAITING TIME

F/D = FREQUENCY DOWN MTTR = MEAN TIME TO REPAIT TIME MTBF = MEAN TIME BETWEEN FAILURE

% D/T = (TTL D/T / AVAILABLE HOURS) X 100 M/C UPTIME= AVAIL – TTL (M/C DOWNTIME)

UTILISATION = M/C UPTIME - (PE,CAL,MAT'L) TTL AVAILABLE = TTL. M/C x DAY x SHIFT x HRS

Source: NS Electronics Bangkok (1993) Co., Ltd.

Figure 3.2: The example of machine utilisation report.

The machine utilisation report is usually classified by type or model of machine because they are designed with the same concepts. Based on the above utilisation report, the result of analysis is below.

% Machine down time	:	5.31
% Machine uptime	:	94.69
% Machine utilisation	:	80.89

The following figure illustrates diagram of time classification.

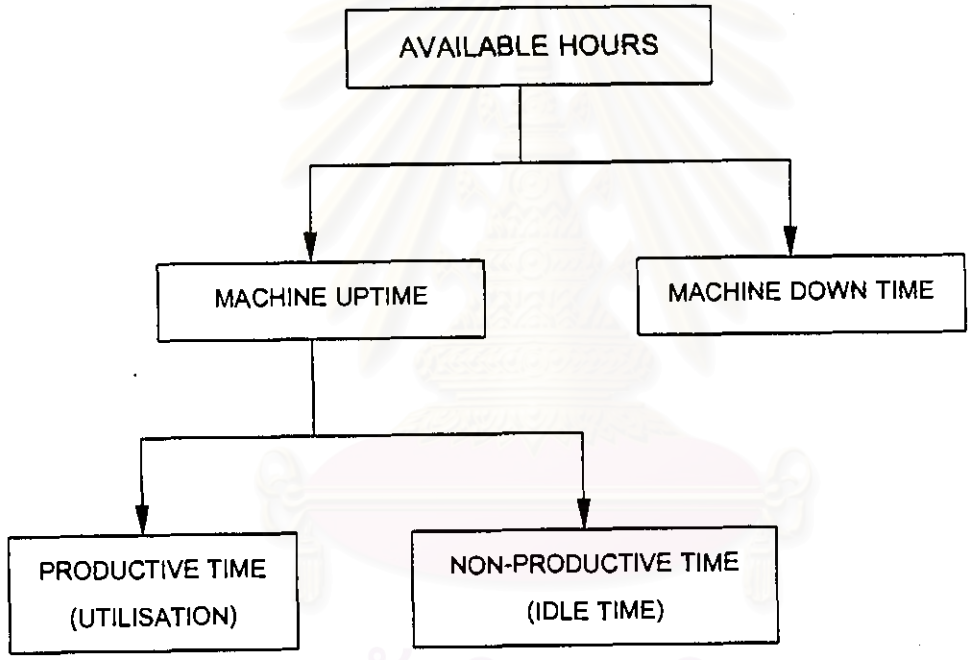

Figure 3.3: The diagram of time classification for a machine.

Among these information, the machine utilisation is the most useful for further analysis in the company.

3.3 Machine capacity

If the number of product made by the machine per hour (UPH) is known, the capacity of the machine will be calculated. The UPH is a number that provides the quantity of units that are produced by each machine type / model per hour when the machine is utilised fully and not disturbed by any errors. It indicates the ideal capacity of the machine. However, machine is not utilised fully, the errors always occur during the machine operations. Therefore, it is difficult to achieve this number. For example, the above utilisation report shows that ESEC die attach machine is used by 80.89% of available hours for production.

Hence, real machine capacity should depend upon the machine utilisation. The real capacity of machine is calculated by refer to the below formula.

Capacity per hour = Machine UPH X Machine utilisation

This number is useful for calculation of machine requirement. However, machine capacity is usually converted to be "Capacity per day" because the number of daily loading of product is known. Thus, the capacity per hour shall be multiplied by number of working hour per day as indicated in below formula.

Capacity per day = 23 X (Machine UPH X Machine utilisation)

Note: The company allows 1 hour per day for non-productive purpose activities.

For example, if machine can produce 3671 units per hour and refer to above number of machine utilisation (80.89%), the capacity of ESEC machine is 2969.47 units per hour or 68,297.85 units per day. This number is useful for further analysis.

3.4 Machine requirement.

The machine that required to supports the production depends upon the number of product that will be loaded. This number usually is planned ahead and provided in the term of daily loading. Since the machine capacity per day has been known, the number of machine required for the daily loading is easily calculated by using the following formula.

$$\text{Number of machine required} = \frac{\text{Daily loading}}{\text{Machine capacity per day}}$$

For example, if the 361,450 units are loaded to ESEC die attach machine, 5.29 machines will be required for production. Therefore, the production department is able to prepare the adequate machine to support the loading.

3.5 Mean Time Between Failure (MTBF)

Based on the data on down time card, MTBF of the machine can be defined. MTBF can be used to study the failure mode and characteristic of the machine. The longer MTBF is preferable because it indicates the effectiveness of machine and maintenance. The Preventive Maintenance department will closely monitor on the machine that has short MTBF to fix the problem as fast as possible.

3.6 Problem on current process

The machine down time card is manually recorded by the operator and technician. Hence, the available of information on down time depends on them. If they do not record some information of machine activity or errors onto the card, the analysis will be incorrect. Therefore, it may lead to wrong planning of machine for production, and inadequate machine.

The company always encounters the problem of inadequate machine for production. It is not because of over loading to the machine but incorrect information on the down time cards is the root cause of this problem. When the machine is inadequate, some batch of product has to wait for available machines and leads to delay submission to the customers.

Moreover, the company always requires maximising the machine utilisation so that the correct information is necessary. If the machine utilisation report does not represent the actual information, it is difficult to improve the machine utilisation.

Because the die attach machine does not interface to external host computer (stand-alone system) so that status of machine can not be monitored in real time. If the status of machine is required, the machine needs to be approached directly. In additional, if the machine can not be monitored in real time and require approach to the machine directly, it is difficult to manage the machine.