

SET UP REDUCTION ON SHEET METAL FABRICATION COMPANY C's CNC PUNCHING SECTION

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School of Mechanical Engineering

Engineering Campus

Universiti Sains Malaysia

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed (LOH HONG YI)

Date

STATEMENT 1

I hereby give consent for my final year report, if accepted, to be available for photocopying and for interlibrary loan, and for the title and summary to be made available outside organizations.

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Date

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Abstract

To stand up in today's globalization world, manufacturers are searching for alternative to reduce production time and cost to improve operating performance. As set up time is non-value added process to customers, manufacturers want to reduce set up time in their operation as low as near to zero. Company C, a sheet metal manufacturer want to achieve the same thing. This project is aim to provide positive result or impact on reduction of set up time in Company C's CNC Punching operation. The objective of this project is to minimize trip to get material by operator and to minimize need of re-calibrate of die during set up.

Abstrak

Dalam dunia globalisasi hari ini, pengilang mencari alternatif untuk mengurangkan masa pengeluaran dan kos untuk meningkatkan prestasi operasi. Operasi set up adalah proses yang tidak tambah nilai kepada pelanggan. Oleh itu pengeluar mahu mengurangkan masa menetap dalam operasi mereka serendah berhampiran kosong. Syarikat C, pengeluar kepingan logam mahu mencapai matlamat yang sama. Projek ini adalah bertujuan untuk memberikan keputusan yang positif atau kesan ke atas pengurangan masa menetap dalam operasi tebukan CNC di Syarikat C. Objektif projek ini adalah untuk meminimumkan perjalanan untuk mendapatkan bahan oleh operator dan untuk mengurangkan keperluan penentukuran semula alat die semasa set up.

1.0 Introduction

Lean manufacturing is a systematic method or concept for waste elimination in manufacturing system. Lean manufacturing derived from the Toyota Production System or Just-in-Time production. Applying lean concept in improvement, the first step is to identify waste or non-value added activities in the process and its root cause. There are 8 waste of lean, which is Defect, Waiting, Over-produce, Over-process, Transportation, Inventory, Motion, and Non-utilized Talent. Waiting waste means by the process or value added activity is on hold or waiting for enabler or certain events before proceed. [1] [2]

Set up time is time taken to prepare the manufacturing processes and system for production, and changeover time is time taken to modify the production line for different products or new batches of the same product. Set up is a process that is not adding any value to the product or does not bring any values to customer. Therefore, set up time is a waste in a process. [3] [4]

Reducing set up time to zero could cost an organization a lot in term of time, manpower and money. However, company still commit into it because they see reducing set up time are not only benefiting in term of productivity. By reducing setup, organization would have better customer responsive or better production flexibility. Besides, production can produce with small batch size with quick set up for processes, this effects work-in-progress (WIP) in production, which would lead lower level of inventory.

Group Technology (GT) is a technique or method for manufacturer to gather products or components which have similarities in geometry, manufacturing process and/or functions to be manufactured in one location using a small number of machines or processes. Grouping parts with similar manufacturing characteristics such as tools used, material used and so on into parts families will reduce the time spent on setups of parts and tools. Informal parts classification and coding technique are used to identify families with similar manufacturing. The code should be able to describe the part from both a design and a manufacturing point of view, such as material use, dimension of the product and so on. [5]

The project is to reduce setup time for Company C's CNC (computer numerically controlled) punching process with application of Group Technology (GT) to create informal code and group parts families and re-sequence daily production schedule with GT and the informal codes. Company C, a company with core business of providing integrated service in sheet metal fabrication, as well as electro mechanical assembly and precision metal fabrication to value added assembly. CNC punching is a sheet metal manufacturing process that is carried out by CNC punch presses. The CNC punching machine is basically programmed to move a sheet of metal or a punching ram in an x and y direction to accurately position to punch a hole or form in sheet metal with thickness range from 0.5 mm to 6mm. In Company C, single head and tool rail (Trumpf) machine is used. 3 type of machine model is serving for Company C, which is Trumpf TC 500, Trumpf TC 5000 and Trumpf TC6000. [6]

2.0 Problem statement

In CNC punching, after a batch of production by a CNC punching machine, the machine will stop and set up is done on the machine by operators for next batch of production. In this set up operation, recalibrating die is one of the process during set up. Recalibrating die need to be done when next batch of production will be using same die as previous production. To reduce machine idle time due to waiting for set up operation done on the machine, recalibrating die process need to avoid or minimize the need for the process.

Besides, operators are transporting material (blank metal sheet) from store to CNC punching station daily. Sometime this material handling process need to be done few time in a day. Operator only informed what to produce or what blank is needed in a day. To reduce operator spending time in taking trips to store and back to CNC punching station, material needed for a week production will be done on single trip only, and the trip needed be done once in a week.

3.0 Objective

- To minimize need of recalibrate of die during set up
- To minimize trip to get material (blank sheet)

4.0 Methodology

Two objective of this project are mainly achieved with creating and working with database. The methodology to develop the database is planned and discussed with project guidance engineer.

As there are two objective, there will be two part of methodology to create two system in this project. Which is material list generator system and CNC punching tools database system. Both system is created using Microsoft Access, also will be run with Microsoft Access.

4.1 Development of material list generator system

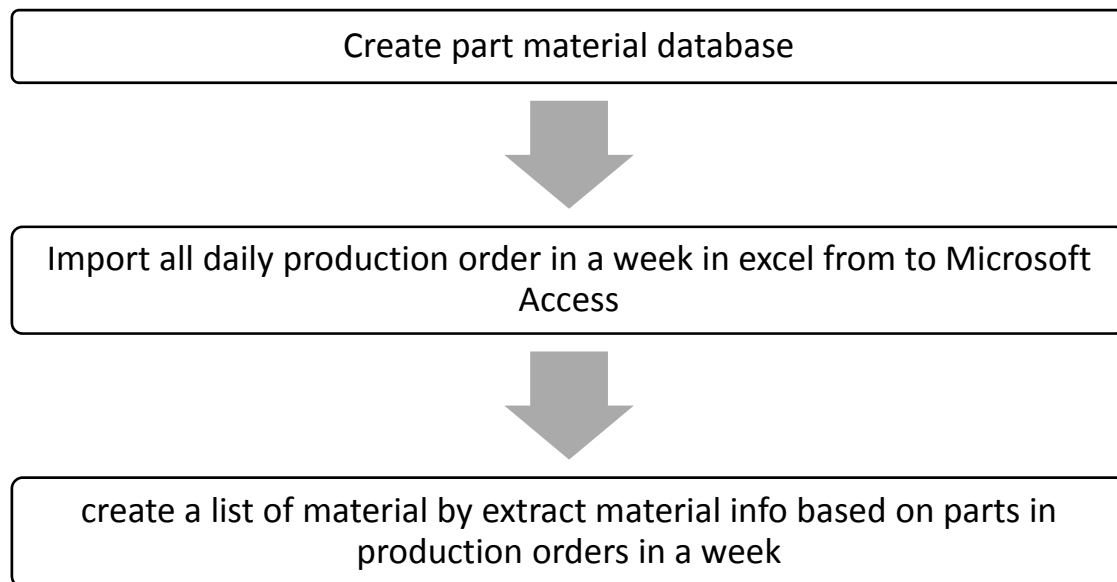


Figure 1: general steps to develop material list generator system

Figure 1 shows the general steps taken to develop the material list generator system. After discussion with engineer in company C, idea to minimize trip to get material (blank sheet) is to have a database system to generate a list of material needed for week production. So operator will able to obtain material for a week in one time.

4.1.1 Create part material database

To create material database in Microsoft Access, getting data or information about material used to produce part is the first step. Company C has provided route card of all product produced by Company C. From the route card, information about part such as blank material, process to produce, and many more. In this project, information of blank material for parts will be use. All material information was planned to import to Microsoft Access database, but due to time constraint, in this project only 1500 parts has been key in. Figure 2 shows material database store information about part material in spreadsheet form.

Product	Part Number	Base Material	Punching process	Size
1	ET1028434-04100	AL 5052 H32	Punching	1.0 x 1219 x 2438 mm
2	N9000-00115	AL 5052 H32	Punch & laser	1.60mm X 2438mm X 1219mm
3	16200-00604	AL 5052 H32	Punching	1.00 x 1219 x 2438mm
4	16200-00621	AL 5052 H32	Punching	1.60 x 1219 x 2438mm
5	16200-00626	AL 5052 H32	Punching	1.60 x 1219 x 2438mm
6	16380-00271	AL 5052 H32	Punch & laser	3.00 x 1219 x 2438 mm
7	16381-00671	AL 5052 H32	Punch & laser	1.00 x 1219 x 2438 mm
8	16382-00671	AL 5052 H32	Punch & laser	1.00 x 1219 x 2438 mm
9	16383-00671	AL 5052 H32	Punch & laser	1.00 x 1219 x 2438 mm
10	16383-00672	AL 5052 H32	Punching	1.60 x 1219 x 2438mm
11	16384-00671	AL 5052 H32	Punch & laser	1.00 x 1219 x 2438 mm
12	C0040-6126-95	AL 5052 H32	Punching	2.30mm x 1219mm x 2438 mm
13	42031-00261	AL 5052 H32	Punching	1.00 x 1219 x 2438mm
15	42031-00662	AL 5052 H32	Punching	1.20 x 1219 x 2438mm
16	42031-00663	AL 5052 H32	Punching	1.20 x 1219 x 2438mm
17	42031-04602	AL 5052 H32	Punching	1.60 x 1219 x 2438mm
31	16048-00671-1.1	AL 5052 H32	Punch & laser	1.60mm x 1219mm x 2438 mm
32	16048-00671-1.2	AL 5052 H32	Punch & laser	1.60mm x 1219mm x 2438 mm
33	16048-00671-1.3	AL 5052 H32	Punch & laser	2.00mm x 1219mm x 2438 mm
39	0040-84404	CRS	Punch & laser	2.30 x 1219 x 2438 mm
40	0040-84404-1	CRS	Punch & laser	2.30 x 1219 x 2438 mm
45	02063	EG	Punch combo	1.20 mm x 1219 x 2438 mm
46	02203	EG	Punching	1.20 mm x 1219 x 2438 mm
112	08757-00061	SUS	Punch combo	0.9 x 1219 x 2438 mm

Figure 2: material database in Access

4.1.2 Import production part list from default production schedule

Next, default production schedule is imported to Microsoft Access as another database. Default production schedule is come in excel file, which current use as production order in CNC Punching station. Therefore, direct import content in excel file into Microsoft Access to work on it. A form is created with 'browse' and 'import file' buttons to import excel schedule into Access. Figure 3 shows the form created. Button is programmed with VBA to action after clicking it, Figure 4 shows VBA coding used on these buttons. Program function is generally allowed user to browse excel file that is production schedule in the computer and set file direction for import function to import the selected file.

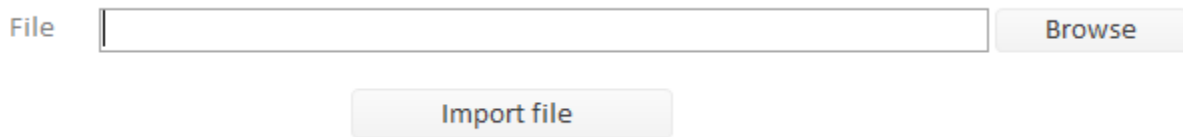


Figure 3: Form used to import Excel production schedule into Access

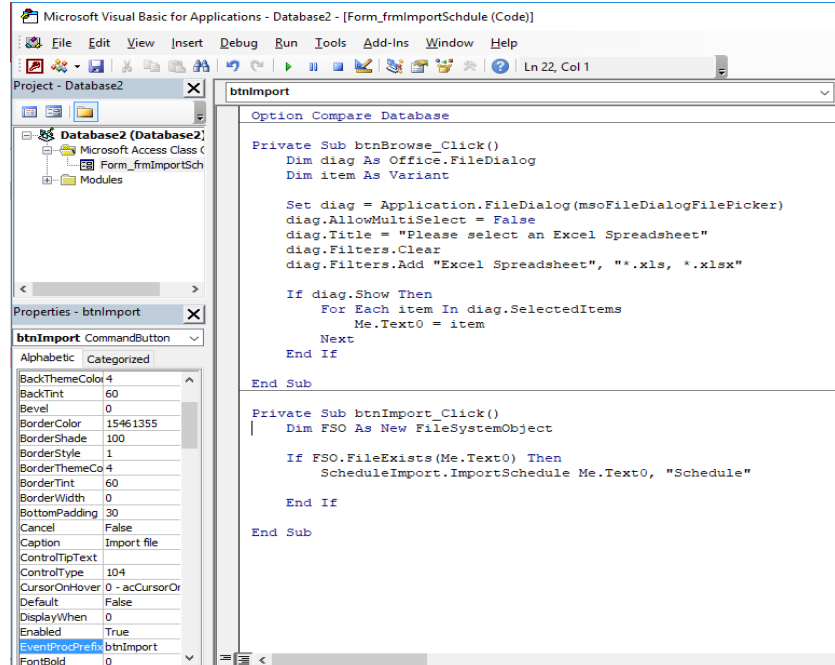


Figure 4: VBA code used for browse and import excel folder by clicking buttons

4.1.3 Create a list of material

A query was created to extract material information from part material database which created earlier based on information of part to be produce from production schedule. Then, a report from query sorting and generate a list of material to be used for a week production.

4.2 Development of CNC punching tools database system

Planning to create such database is done with discussion with engineer of Company C to solve re-calibrating tools during set up. The database is used as tools for decision on adding extra tools set to avoid need of perform re-calibrating tool during internal set up operation. The database can also use for other purpose. Figure 5 shows general steps after planning with engineer of Company C.

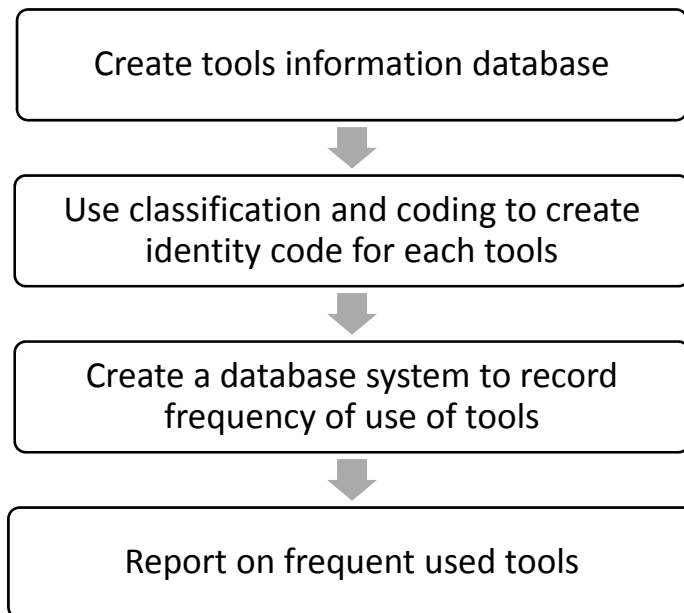


Figure 5: general steps to develop CNC punching tools database system

As record system need to be able to define which die has been record, an informal identity code to represent every die set available in CNC Punching is needed. Therefore, a coding system needed to create for specific identity code to represent die sets in CNC Punching. The identity code also required to carry general die information and easy to read the information carried with

the identity code. To achieve the development above, create a die information database will be first steps.

4.2.1 Create die information database

Die information database created with Microsoft Access. Figure 6 show steps to create die information database.

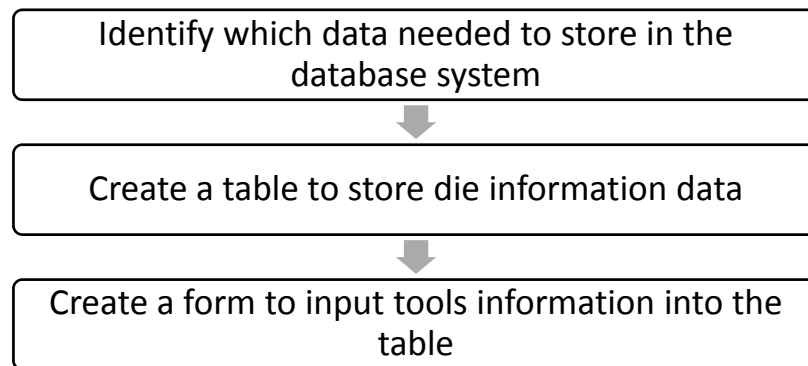


Figure 6: steps to create die information database

Data needed to store was advice by engineer of Company C. The data needed was die type, die dimensions and die remark. These data used to generate die identity code on next step after database creation. A table is created to store these data of each die set in CNC Punching. Then, a form in Access is create for better data input interface.

4.2.2 Create Die code

After having database of die information, a sample of die is input into the database. As record system need to be able to define which die has been record, an informal identity code to represent every die set available in CNC Punching is needed. Similar with concept of identity card number for individual human being. A coding system needed to create for identity code to represent die sets in CNC Punching. Figure 7 shows general steps for identity code building.

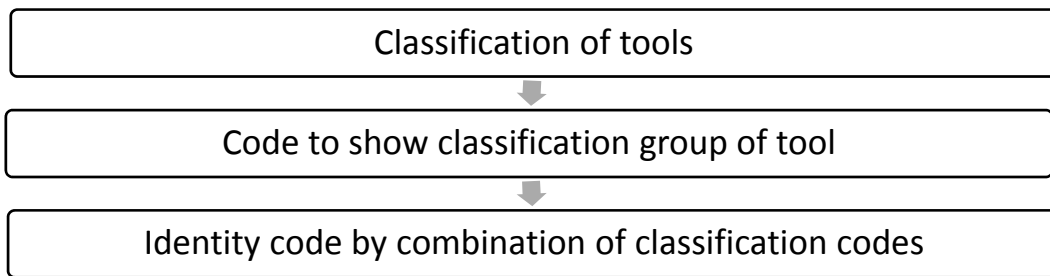


Figure 7: General steps for identity code building

Classification according information given is perform. Multilevel classification will be done until able to differ all die and each die differences between each other that represent itself only. After all classification steps as mention, every die will have specific classification identity, a coding method is created to represent the classification and the specific die.

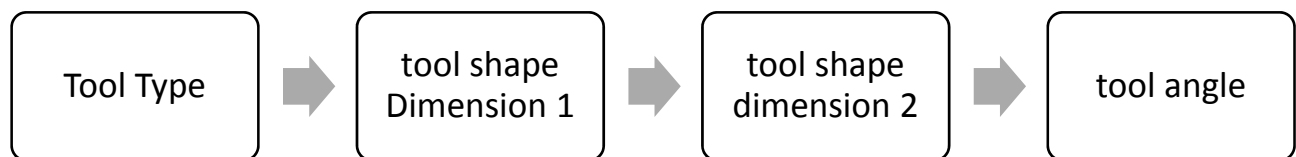


Figure 8: Multilevel classification

As show in figure 8, multilevel classification starts with die type, followed by dimensions of dies and lastly die tread. Die type is classification base on type of type, and number code is use to

represent different group for classification. Table 1 shows example of list of number code and die type. New code number can be created for new /shape or type of punch or die.

Code number	Tool type
1	Round punch and die
3	Square punch and die
4	Rectangle punch and die
8	Oblong punch and die
9	MultiCut radii tool
11	Laser tools
13	others

Table 1: list of number code and die type

Next level classification is based on die dimensions. Two level of classification is done on dimensions because different die shape or type have different number of dimension. For Example, round die will only have one dimensions which is its radius, while square and rectangle die have 2 dimensions which is width and length. So, die dimension 1 is the radius or width of the die and dimension 2 is the length of the die. Die angle is an attribute in certain type die. In this project, the die sample provided did not have this type of die but mention by engineer and require to involve in coding.

The code format will be set according classification. An die code example '04-635-330-000, it is a code of square die with die dimension of 6.35 cm width, 3.3 cm length and zero angle value.

4.2.3 Create database system to record frequency of re-calibrating of die

Die used is key in to database, to record the frequency of use of tools. A form is created to key in part number and tool used and record as a data in a table. Find duplicates record query is used to extract information from die used records and create a report to show the frequency of use of die.

5.0 Development

5.1 Material list generator

5.1.1 Form to import production schedule to Access

A form is created for user to import production schedule which as excel file as default into Access. The imported excel spreadsheet will store in Access in table form, and will be used to get product/part list to be produce in a week time. The form shows in Figure 9.

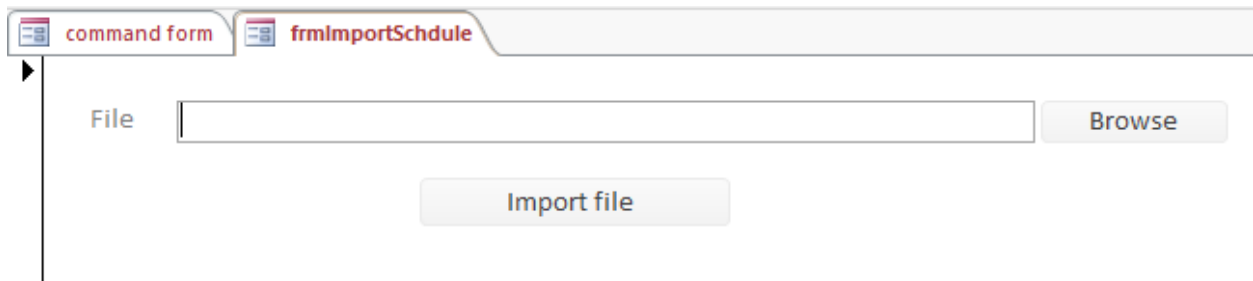


Figure 9: Form to import production schedule to Access

To use this form, first user will need to click browse button located at side of blank text box. Figure 10 shows interface after clicking browse. Then locate and select the production schedule excel file, then click 'OK'.

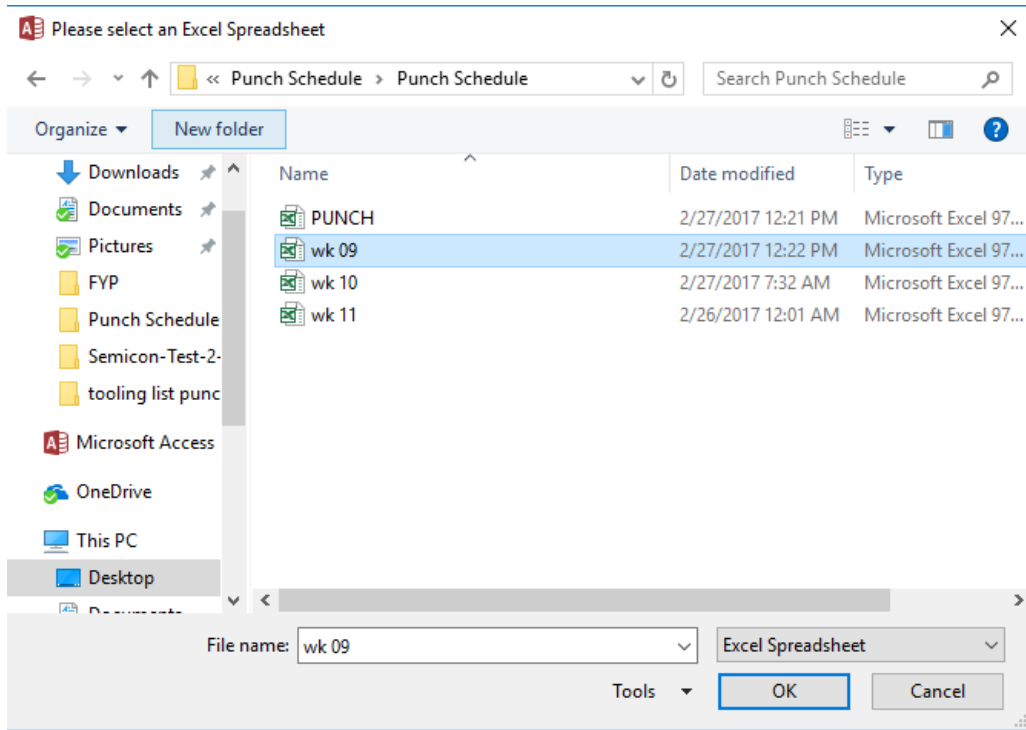


Figure 10: Interface after click 'Browse'

After that, text box will show the direction of file where the production schedule located and will be import to Access. Click 'Import File' button to import the schedule. Figure 11 shows direction of file in import form's text box. Figure 12 shows table of imported production schedule, and figure 13 shows original production schedule in excel file.

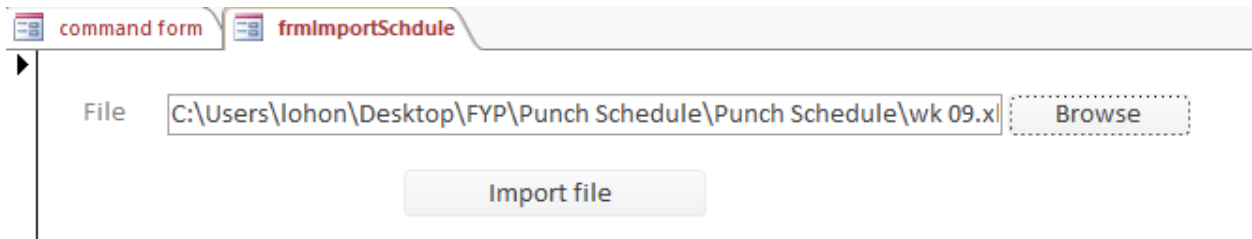


Figure 11: Direction of file in import form's text box

Part #	JO#	MR#	Planned qty	Status	Planned dat	Machine	Set up time	std time (mi)	Total mins	Tgt / hr	F12
N5245-00011	JKT160996	MR16120501	72	awt cnc	27-Feb	TC 6000	30	0.83	90.00	72	
N5245-00006	JKT160992	MR16120497	52	awt cnc	27-Feb	TC 5000	30	3.16	194.21	19	
N5224-00003	JKT160965.001	MR16120470	56	awt cnc	27-Feb	TC 5000	30	1.15	94.62	52	
N5242-00019	JKT160988	MR16120493	104	awt cnc	27-Feb	TC 500	30	1.18	152.35	51	
N5245-00008	JKT160994	MR16120499	60	awt cnc	27-Feb	TC 500	30	2.73	193.64	22	
E5061-01221	JJA170170	MR17020015	190	awt cnc	27-Feb	TC 5000	30	0.71	164.12	85	
E4990-00674-1.	JJA170166.001	MR17020011	150	awt cnc	27-Feb	TC 5000	30	1.40	239.30	43	
E4990-00674-1.	JJA170166.002	MR17020011	150	awt cnc	27-Feb	TC 5000	30	0.94	170.63	64	
E5052-00611	JJA162013	MR16110367	25	awt cnc	27-Feb	TC 5000	30	0.54	43.51	111	
E5052-00611-2	JJA162013.001	MR16110367	25	awt cnc	27-Feb	TC 5000	30	0.75	48.75	80	
E5052-00611-3	JJA162013.002	MR16110367	25	awt cnc	27-Feb	TC 5000	30	0.72	48.07	83	
N9020-00016	JJA161885	MR16110070	217	awt cnc	27-Feb	TC 5000	30	0.81	205.95	74	
839-121582-003	JJA170201.001	MR17020095	620	awt cnc	27-Feb	TC 5000	30	1.00	650.00	60	
U2000-04401	JKT170112.001	MR17020144	10	awt cnc	27-Feb	TC 6000	30	0.91	39.09	66	
T1255-00009	JKT170107	MR17020121	10	awt cnc	27-Feb	TC 6000	30	1.11	41.11	54	
E5070-00656	JKT160940	MR16120445	75	awt cnc	27-Feb	TC 6000	30	0.17	42.50	360	
G5409-00004	JAS160932.001	MR16120346	30	awt cnc	27-Feb	TC 6000	30	0.53	45.93	113	
G5409-00005	JAS160932.002	MR16120346	150	awt cnc	27-Feb	TC 6000	30	0.08	42.05	747	
470-014-501-2	JPL170076.001	MR17010171	15	awt cnc	27-Feb	TC 500	30	1.30	49.57	46	
470-014-501-3	JPL170076.002	MR17010171	15	awt cnc	27-Feb	TC 500	30	1.11	46.67	54	
0041-05888	JMS170002	MR17020177	105	awt cnc	27-Feb	TC 6000	30	2.40	282.00	25	
11683-00001	JVM170089	MR17020081	7	awt cnc	27-Feb	TC 5000	30	1.07	37.50	56	

Figure 12: production schedule imported to Access

Part #	JO#	MR#	Planned	Status	Planned	Machine	Set up tir	std time (m)	Total mi	Tgt / h
N5245-00011	JKT160996	MR16120501	72	awt cnc	27-Feb	TC 6000	30	0.83	90.00	72
N5245-00006	JKT160992	MR16120497	52	awt cnc	27-Feb	TC 5000	30	3.16	194.21	19
N5224-00003	JKT160965.001	MR16120470	56	awt cnc	27-Feb	TC 5000	30	1.15	94.62	52
N5242-00019	JKT160988	MR16120493	104	awt cnc	27-Feb	TC 500	30	1.18	152.35	51
N5245-00008	JKT160994	MR16120499	60	awt cnc	27-Feb	TC 500	30	2.73	193.64	22
E5061-01221	JJA170170	MR17020015	190	awt cnc	27-Feb	TC 5000	30	0.71	164.12	85
E4990-00674-1.2	JJA170166.001	MR17020011	150	awt cnc	27-Feb	TC 5000	30	1.40	239.30	43
E4990-00674-1.3	JJA170166.002	MR17020011	150	awt cnc	27-Feb	TC 5000	30	0.94	170.63	64
E5052-00611	JJA162013	MR16110367	25	awt cnc	27-Feb	TC 5000	30	0.54	43.51	111
E5052-00611-2	JJA162013.001	MR16110367	25	awt cnc	27-Feb	TC 5000	30	0.75	48.75	80
E5052-00611-3	JJA162013.002	MR16110367	25	awt cnc	27-Feb	TC 5000	30	0.72	48.07	83
N9020-00016	JJA161885	MR16110070	217	awt cnc	27-Feb	TC 5000	30	0.81	205.95	74
839-121582-003-A	JJA170201.001	MR17020095	620	awt cnc	27-Feb	TC 5000	30	1.00	650.00	60
U2000-04401	JKT170112.001	MR17020144	10	awt cnc	27-Feb	TC 6000	30	0.91	39.09	66
T1255-00009	JKT170107	MR17020121	10	awt cnc	27-Feb	TC 6000	30	1.11	41.11	54
E5070-00656	JKT160940	MR16120445	75	awt cnc	27-Feb	TC 6000	30	0.17	42.50	360
G5409-00004	JAS160932.001	MR16120346	30	awt cnc	27-Feb	TC 6000	30	0.53	45.93	113
G5409-00005	JAS160932.002	MR16120346	150	awt cnc	27-Feb	TC 6000	30	0.08	42.05	747
470-014-501-2	JPL170076.001	MR17010171	15	awt cnc	27-Feb	TC 500	30	1.30	49.57	46
470-014-501-3	JPL170076.002	MR17010171	15	awt cnc	27-Feb	TC 500	30	1.11	46.67	54
0041-05888	JMS170002	MR17020177	105	awt cnc	27-Feb	TC 6000	30	2.40	282.00	25
11683-00001	JVM170089	MR17020081	7	awt cnc	27-Feb	TC 5000	30	1.07	37.50	56

Figure 13: Original production schedule in excel file

5.1.2 Query to generate material list report

To generate material list report, a query is created. The creation is begin with select create query in Access, and select 'Part Material' and imported production schedule to work on. Then, create a link of 'Part number' field from Part material list table and 'Part #' field from imported schedule table. Then select 'size' field and 'planned qty' field as we need this data in our report. Figure 14 shows the end of query set up, and figure 15 shows table after query run.

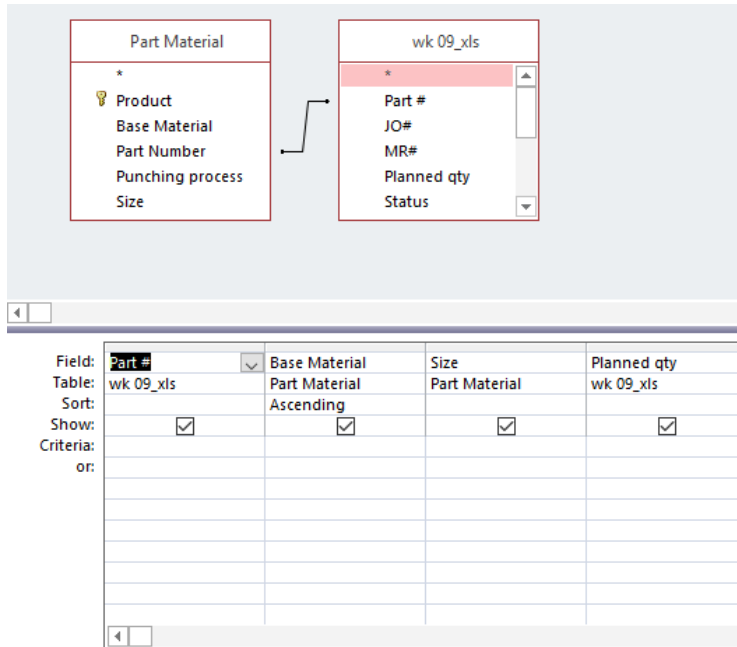


Figure 14: End of query set up

Part #	Base Material	Size	Planned qty
839-121582-005	AL 5052 H32	1.60mm x 1219mm x 2438 mm	620
N5245-00006	AL 5052 H32	1.60mm x 1219mm x 2438 mm	52
N5224-00003	AL 5052 H32	1.60mm x 1219mm x 2438 mm	56
N5242-00019	AL 5052 H32	1.60mm x 1219mm x 2438 mm	104
N5245-00008	AL 5052 H32	1.60mm x 1219mm x 2438 mm	60
E4990-00674-1.	AL 5052 H32	0.90mm X 1219mm X 2438 mm	150
E4990-00674-1.	AL 5052 H32	0.90mm X 1219mm X 2438 mm	150
N5245-00011	AL 5052 H32	0.90mm X 1219mm X 2438 mm	72
N9020-00016	AL 5052 H32	1.60mm x 1219mm x 2438 mm	217
T1255-00009	AL 5052 H32	2.30 x 1219 x 2438 mm	10
470-014-501-2	AL 5052 H32	2.30 x 1219 x 2438 mm	15
G5409-00004	AL 5052 H32	2.30 x 1219 x 2438 mm	30
470-014-501-3	AL 5052 H32	2.30 x 1219 x 2438 mm	15
470-014-501-3	AL 5052 H32	2.30 x 1219 x 2438 mm	15
G5409-00005	AL 5052 H32	2.30 x 1219 x 2438 mm	150
470-014-501-2	AL 5052 H32	2.30 x 1219 x 2438 mm	15
E5070-00656	AL 5052 H32	2.30 x 1219 x 2438 mm	75
E5052-00611	CRS	0.90mm X 1219mm X 2438 mm	25
E5052-00611-2	CRS	0.90mm X 1219mm X 2438 mm	25
E5052-00611-3	CRS	0.90mm X 1219mm X 2438 mm	25
11683-00001	EGPN	2.30 x 1219 x 2438 mm	7
0041-05888	EGPN	2.30 x 1219 x 2438 mm	105
U2000-04401	SUS 3042B	0.90mm X 1219mm X 2438 mm	10
E5061-01221	SUS 3042B	0.90mm X 1219mm X 2438 mm	190

Figure 15: data extracted by query from part material and schedule tables

5.1.3 Material list report

Data extracted from query is convert to a report, that contain base material needed for week production. Figure 16 shows the report create default from query. The report is then further modified on layout arrangement, sorting and summation of material to become final version report. Final version report is more friendly readable from default report. Figure 17 shows modified final version report.

MaterialList			Monday, May 29, 2017
			4:04:11 PM
Part #	Base Material	Size	Planned qty
N5245-00011	AL 5052 H32	0.90mm X 1219mm X 2438mm	72
N5245-00006	AL 5052 H32	1.60mm x 1219mm x 2438 mm	52
N5224-00003	AL 5052 H32	1.60mm x 1219mm x 2438 mm	56
N5242-00019	AL 5052 H32	1.60mm x 1219mm x 2438 mm	104
N5245-00008	AL 5052 H32	1.60mm x 1219mm x 2438 mm	60
E5061-01221	SUS 3042B	0.90mm X 1219mm X 2438mm	190
E4990-00674-1.2	AL 5052 H32	0.90mm X 1219mm X 2438mm	150
E4990-00674-1.3	AL 5052 H32	0.90mm X 1219mm X 2438mm	150
E5052-00611	CRS	0.90mm X 1219mm X 2438mm	25
E5052-00611-2	CRS	0.90mm X 1219mm X 2438mm	25
E5052-00611-3	CRS	0.90mm X 1219mm X 2438mm	25
N9020-00016	AL 5052 H32	1.60mm x 1219mm x 2438 mm	217
839-121582-003-A01	AL 5052 H32	1.60mm x 1219mm x 2438 mm	620
U2000-04401	SUS 3042B	0.90mm X 1219mm X 2438mm	10
T1255-00009	AL 5052 H32	2.30 x 1219 x 2438 mm	10

Figure 16: default report creation from query

MaterialList		Wednesday, June 7, 2017	
Base Material	Size	Planned qty	Part #
AL 5052 H32			
		30	
		15	470 014 501 3
		15	470 014 501 2
	0.90 mm X 1219 mm X 2438mm	372	
		150	E4990 00674 1.2
		150	E4990 00674 1.3
		72	NS 245 00011
	1.60 mm x 1219mm x 2438 mm	1109	
		620	839 121582 003 A01
		52	NS 245 00006
		56	NS 224 00003
		104	NS 242 00019
		60	NS 245 00008
		217	N9020 00016
	2.30 x 1219 x 2438 mm	295	
		10	T1255 00009
		75	E5070 00656
		30	G5409 00004
		150	G5409 00005
		15	470 014 501 2
		15	470 014 501 3
CR5			
	0.90 mm X 1219 mm X 2438mm	75	
		25	E5052 00611 3

Figure 17: modified final version report for better readability

5.1.4 Form to input data to part material list

A form is created for better user interface to input new data or records to part material database. The form is show in Figure 18.

Figure 18: form to key in data or records to part material database

Once the form is open, user will key in data of part number, base material, punching process, and blank size. Blank size will have a standard format to key in, to standardize data format in database. Once all data key in is done, click the save button which have a discard icon and is located bottom of size format. To exit the form, user can click exit or 'x' button on right top corner.

5.2 Concept of CNC punching tools database system

5.2.1 Form to input die info database

A form is created for user to input into Die info database. Figure 19 show the form created. The database will contain information of tools such as die type, dimensions, angle, remark and also die code. The die code is key in by user, with coding method designed for this project.


Die info	
TYP	1
DIM 1	6.20
DIM 2	0.00
DIM 3	0.00
ANGLE	0.00
REMARK	Round 6.20 M10
Die code	01-0620-0000-000
Exit	

Figure 19: Form input of data for die information table

5.2.2 Form to record die used for production

A form is created for user to record die or tool used. The database will store records of which part is produced and which die is used. In this record, every die or tools have to be key in once a time. Which means if the part is produced using 5 die set, 5 times data entry have to be done on each die used respectively. Figure 20 shows the form created for user to entry die used record. Data to key in in this form is Part number, Die code for die used and times (data use for query function later on), which will be always 1.


Die used record	
Part number	N5245-00011
Die used	01-0620-0000-000
Times	1
Exit	

Figure 20: die used record

5.2.3 Query and report of frequency of die used

A query is created to extract records data from die used data base and show it on report. Find duplicates query is used. Find duplicated query have the function to search and list our duplicated records in database, which used to search for same die used to produce same parts in this project. Figure 21 shows the query used for frequency of die used report. Figure 22 show the modified version of report from default report, which has better readability for users.

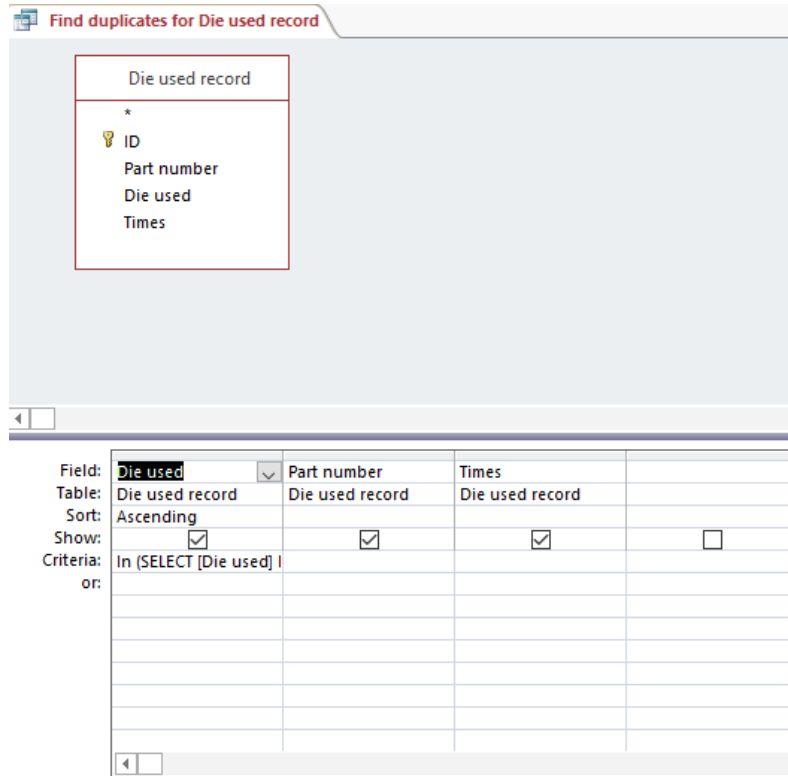


Figure 21: query for frequency of die used report

Find duplicates for Die used record		Wednesday, June 7, 2017
Die Code	Times	
01-0170-0000-000	3	
01-0320-0000-000	2	
01-0330-0000-000	3	
01-0360-0000-000	4	
01-0380-0000-000	2	
01-0410-0000-000	2	
01-0425-0000-000	2	
01-0450-0000-000	2	
01-0475-0000-000	2	
01-0500-0000-000	4	
01-0500-0000-000	3	
01-0620-0000-000	6	
01-1100-0000-000	3	
01-1800-0000-000	2	
03-0400-0000-000	2	
03-0500-0000-000	4	
04-0500-0450-000	5	
04-0683-0200-000	2	
04-1200-0320-000	4	

Figure 22: Final version reports for frequency of die used.

However, user is suggested to export the report to excel file to sort the number of used / times from largest to smallest. To export the report, there is a “Export to Excel Spreadsheet” button in External Data tab. Click the button as circled in Figure 23, then select options accordingly, and sorting it on excel file.

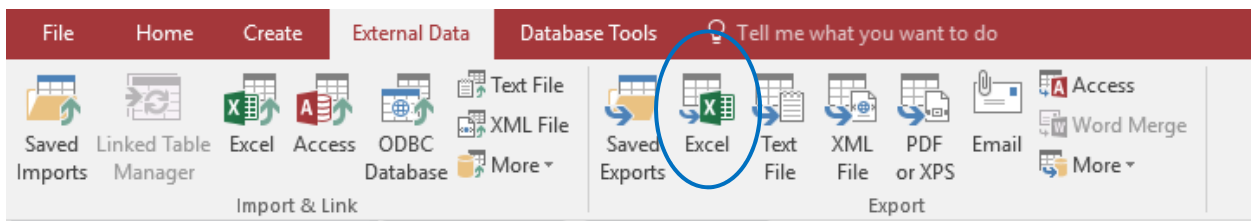


Figure 23: “Export to Excel Spreadsheet” button

6.0 Result

In Company C punching session, the operation operates 24 hours per day, which means 1440 minutes available time for operates

		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
TC6000	Running Time	1090	900	1030	1060	1094	1035	1222	7431
	Percentage %	76%	63%	72%	74%	76%	72%	85%	74%
	Setup Time	140	60	235	265	284	285	68	1337
	Percentage %	10%	4%	16%	18%	20%	20%	5%	13%
	Idle Time	110	105	175	115	62	30	90	687
	Percentage %	8%	7%	12%	8%	4%	2%	6%	7%
	Breakdown	0	375	0	0	0	0	60	435
	Percentage %	0%	26%	0%	0%	0%	0%	4%	4%
TC5000	Running Time	1305	585	1105	1105	1150	1343	1310	7903
	Percentage %	91%	41%	77%	77%	80%	93%	91%	78%
	Setup Time	90	405	285	300	225	25	90	1420
	Percentage %	6%	28%	20%	21%	16%	2%	6%	14%
	Idle Time	45	450	50	35	65	72	40	757
	Percentage %	3%	31%	3%	2%	5%	5%	3%	8%
	Breakdown	0	0	0	0	0	0	0	0
	Percentage %	0%	0%	0%	0%	0%	0%	0%	0%
TC500(1)	Running Time	700	1125	290	605	980	660	710	5070
	Percentage %	49%	78%	20%	42%	68%	46%	49%	50%
	Setup Time	50	155	125	175	230	30	20	785
	Percentage %	3%	11%	9%	12%	16%	2%	0%	8%
	Idle Time	690	160	1025	660	230	750	710	4225
	Percentage %	48%	11%	71%	46%	16%	52%	49%	42%
	Breakdown	0	0	0	0	0	0	0	0
	Percentage %	0%	0%	0%	0%	0%	0%	0%	0%
TC500(2)	Running Time	895	580	690	1050	220	0	0	3435
	Percentage %	62%	40%	48%	73%	15%	0%	0%	34%
	Setup Time	430	50	30	105	20	0	0	635
	Percentage %	30%	3%	2%	7%	1%	0%	0%	6%
	Idle Time	115	810	720	285	1200	1440	1440	6010
	Percentage %	8%	56%	50%	20%	83%	100%	100%	60%
	Breakdown	0	0	0	0	0	0	0	0
	Percentage %	0%	0%	0%	0%	0%	0%	0%	0%

Table 2: OEE of 4 CNC punching machine in Company C in a week

Table 2 shows data of OEE of 4 CNC punching machine in Company C in a week. From the table, both running time for CNC punching model TC 500 in Company C is low, which is 50% and 34 % respectively. Idle time on both machine is 42% and 60%. According to engineer, both TC 500 is not utilize because of job assignment, in other word, these machine is waiting for job. Therefore these machines are not concerned on set up reduction.

On the other hand, TC 6000 and TC 5000 has running time of 74% and 78% of available time. Setup has occupied 13% and 14% of available time for TC 6000 and TC 5000 in this sample data. Idle time has occupied 7% and 8% of available time of TC 6000 and TC 5000.

6.1 Estimation idle time able to save with use of material list generator

TC 6000 and TC 5000 is idling when operator is loading program and getting material from stores. One of the objective in this project is to create a material list generator, to generate a weekly material list for operator to handling or stand by material from store to punching station. This is aim to reduce idle time machine cause by material handling of operator.

Operator is taking material from store 2 times per shift, 4 time for a day (2shift). So, there will be 28 trips made by operator in a week to take material from store to punching station. According Company C engineer, operator is taking material for multiple machine. Therefore, 28 trips is assume to total trip in a week to take material for both TC 6000 and TC 5000 operations.

Idle time of TC 6000 and TC 5000 are 687 minutes and 757 minutes in a week. Taking average of the two idle time, and assuming 50% of idle time is contribute by material handling, 361 minutes is used for 28 material handling trip. Therefore, operator will assume to spend 12.9 minutes to make a trip to take material from store to work station. By using material list to take material for a week, which means from 28 trips we reduce to 1 trip, we able to save 348 minutes per week (361-12.9). That would be 3.4% of total available time per week save from material handling.