



CHAPTER 5

THE IMPROVEMENT BY REPLACEMENT

This chapter will focus on the change improvement after progressive die replacement which is basically in 3 improvements.

5.1 Performance improvement

5.2 Reduce of occupancy

5.3 Layout improvement

5.1 Performance improvement

5.1.1 Improve of lead time

Lead time of making wheel frame will be shorter because of 3 factors 1. Eliminate transportation between process 2. Cycle – time of each process has a steady and shorter than single die 3. Set up time reduce

5.1.1.1 Transportation is eliminated as figure shown below

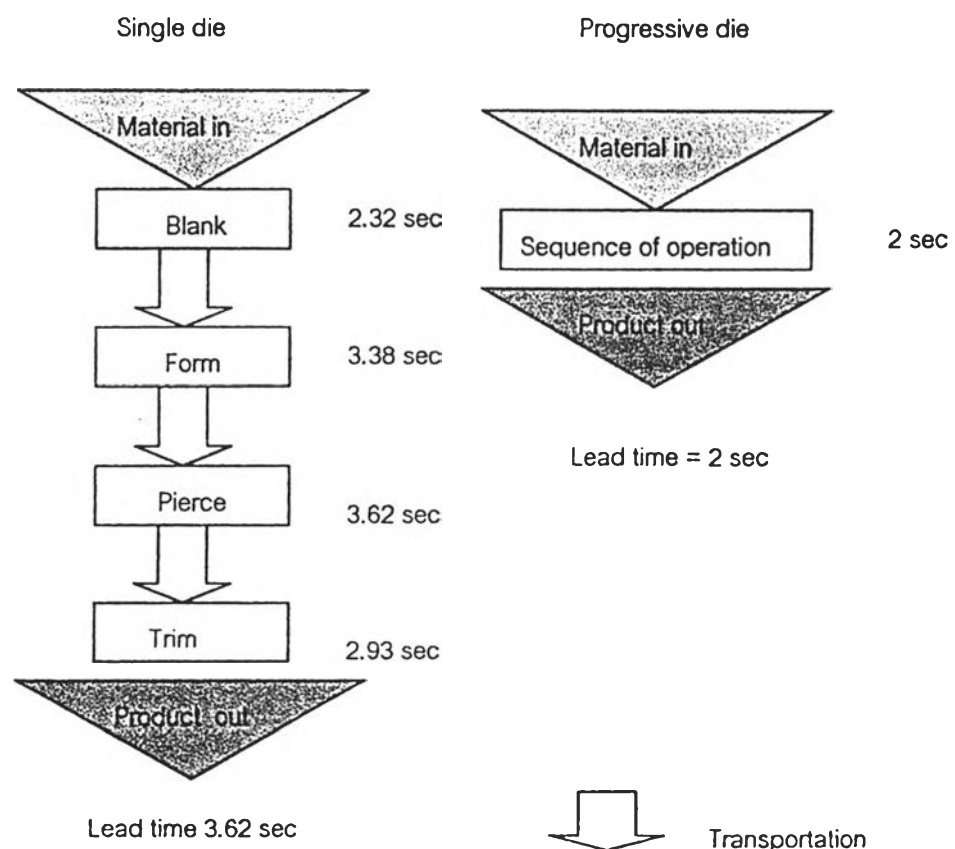


Figure 5.1 Lead time of wheel frame Single die VS Progressive die

Refer to Kaplan .S "lead time" is the longest of cycle time in that process.

- 5.1.1.2 Cycle time is steady and shorter so that lead -time decrease.

Lead time of wheel frame on single die

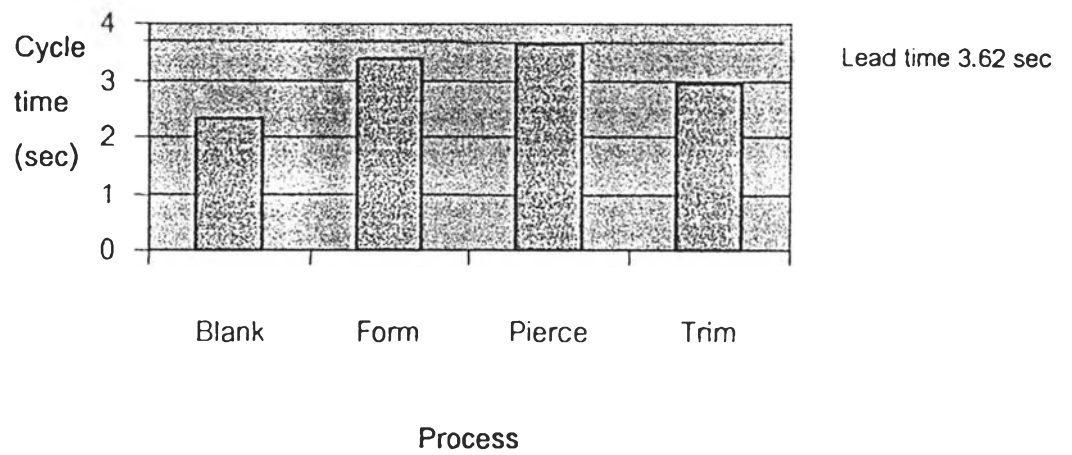


Figure 5.2 Lead time of wheel frame on single die

Lead time of wheel frame on progressive die

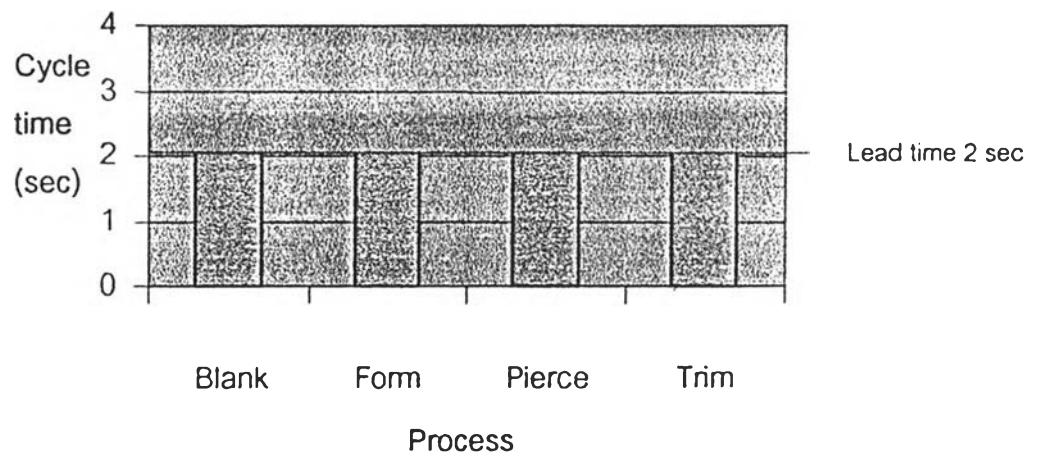


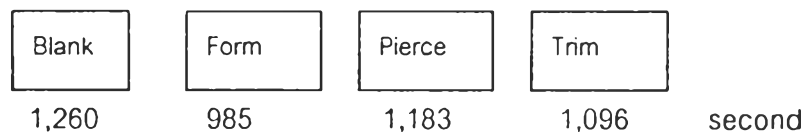
Figure 5.3 Lead time of wheel frame on progressive die

Lead time of single is 3.62 sec because the forming process is the longest time, moreover transportation of work in process to be taken to next process by trolley. Lead time of progressive die is 2 sec equally all processes because it is an automatic work. It eliminates human error and inconsistency. It can be seen that lead-time of progressive die is shorter.

5.1.1.3 Reduce set up time

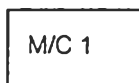
Set up time will reduce because set up time of progressive die occur only once but set up time in single die occur once or more compare to progressive die.

- Set up time in single die



Total set up time = 4,524 second. But in reality, set up time of 4 machines are done by 2 persons so that it takes about half of 4,524 which is 2,262 second.

- Set up time for Progressive die



Set up time* = 1,600 second

*set up time is obtained from Multi parts Co.,Ltd.

Total set up time different = 4,524 – 1,600= 2,924 second

5.1.2 Out put increase

Out put will be increase because lead time is decrease. To calculate out put of progressive die.

- Unit per hour of progressive die

UPH = $\frac{\text{total operating time(sec/hr)}}{\text{Lead time (sec/unit)}}$

Lead time (sec/unit)

Where total operating time = $3,600(\text{sec/hr}) \times (1 - \% \text{allowance at each operation})$

In making wheel, allowance is nil because it is automatic operating.

$$\text{Therefore UPH} = \frac{3,600}{2} = 1,800 \text{ unit/hr}$$

- Out put per day of progressive die

Lead time = 2 sec

Transportation is about 5mins or 300 sec

Set up time = 1600 sec

$$\text{Therefore} = \frac{(7.30 \text{ hrs} \times 3,600 - 1,600 - 300)}{2} = 13,140 \text{ pcs.}$$

It can be seen that output of progressive die is more than single die's = 7,070.33 pcs.

5.2 Reduction of occupancy

5.2.1 Area occupied reduce

Area utilities of progressive die use much less area than single die. It is because progressive die can be operated in 1 machine whereby single die has to operate 4 machines to complete part. Moreover progressive die has eliminated work in process.

Area to be eliminated is listed below.

Machine area for single die and work in process = 150 square metre

Machine area for progressive die is approximately = 50 square metre

Area saved by progressive die replacement = 100 square metre

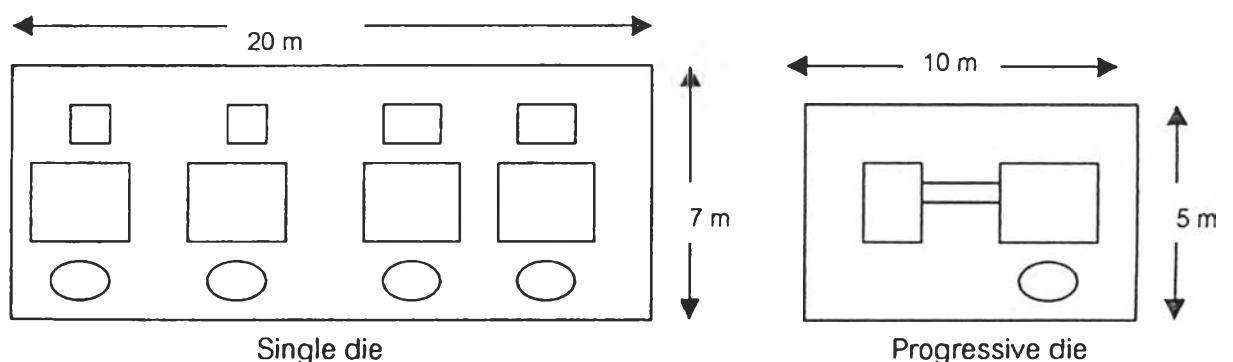


Figure 5.4 Comparison of area occupied

5.2.2 Man power reduce

A number of man power (direct manpower) will reduce from 13 to be 10 once replacement takes place. Because 4 processes from single die will be replaced by 1 progressive die for making wheel frame.

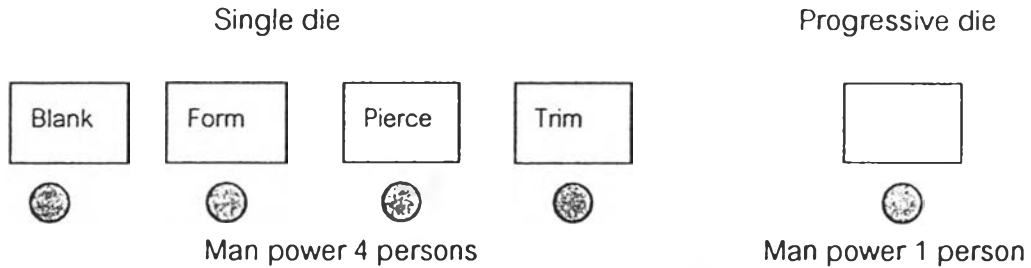


Figure 5.5 Comparison of man power used

5.2.3 Work in process reduce

Work in process reduces when replaced by progressive die because in progressive die , part will run automatically in the sequence of die until fished part ,while single die has part is drop down underneath of machine and need to be transferred to next machine.

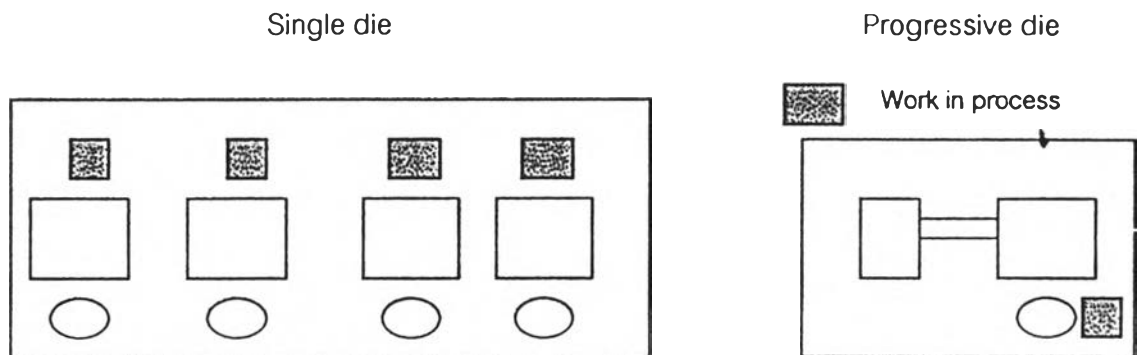


Figure 5.6 Comparison of work in process

5.3 The change in organization

The change after progressive die takes place in organization can be divided into 3 changes.

- 5.3.1 New Process flow
- 5.3.2 New Plant layout
- 5.3.3 New line layout

5.3.1 New Process flow

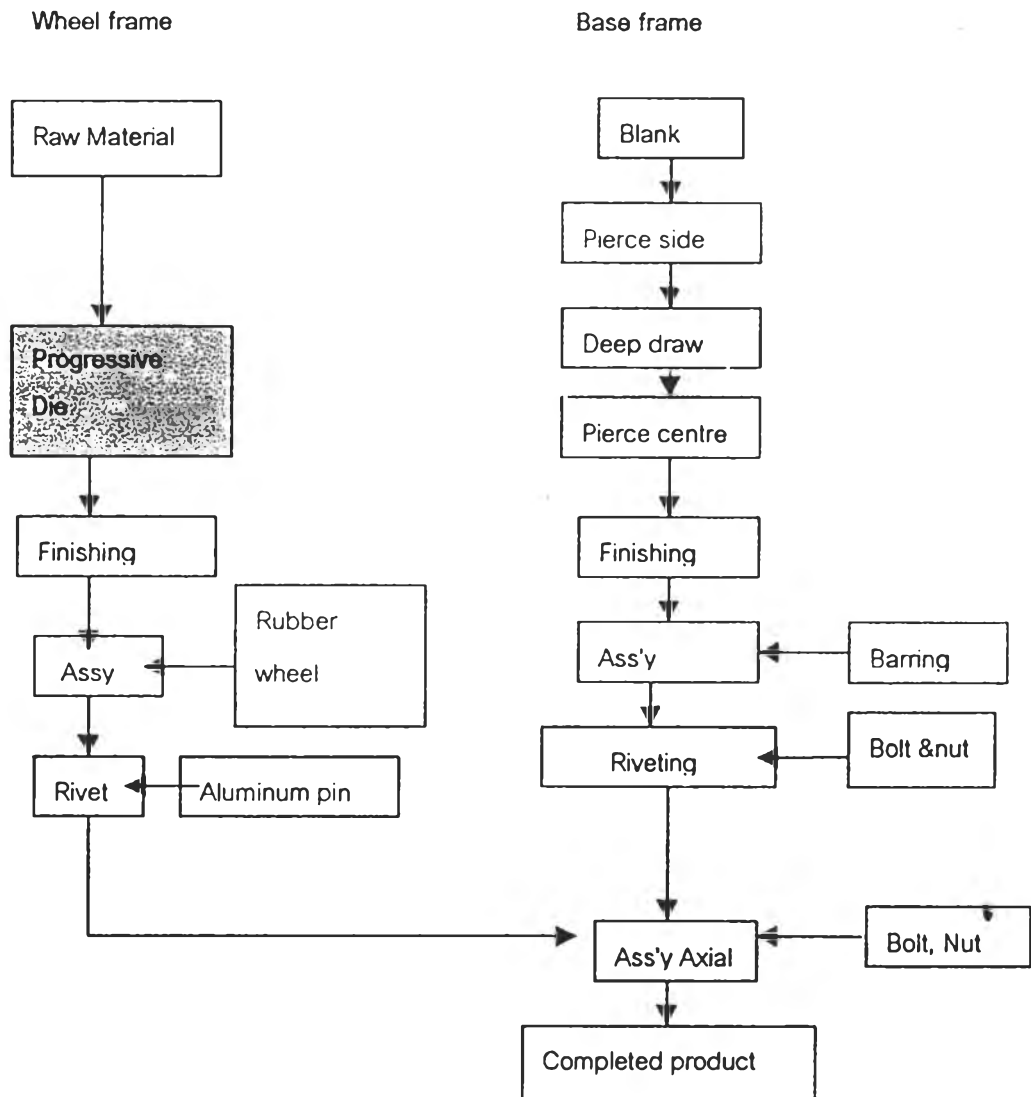


Figure 5.7 New process flow of wheel frame

The new process flow shows the replacement 4 process of single die with 1 progressive die. Therefore 4 machines will reduce to 1 machine once progressive die replaced.

It can be seen in the new process flow that progressive die is replaced, it can eliminate all processes of single die and transportation therefore it is shorten lead-time.

5.3.2 New plant layout

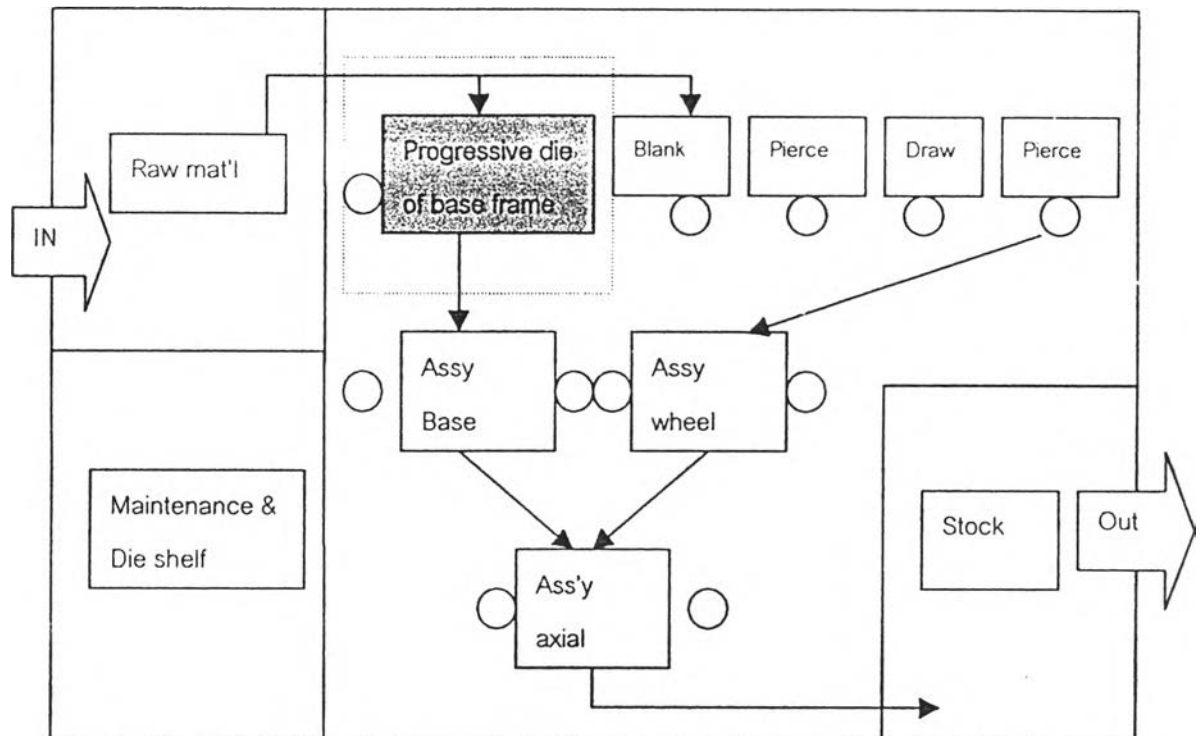


Figure 5.8 New plant layout

In the new lay out ,Progressive die makes more space and more systematic, it support a material flow and flow of process to run smoothly and no bottom neck.

5.3.3 New line layout

New line lay out after progressive die replacement, it will be a " Y line in which 2 stations ,wheel frame line and Base frame line , is separated then assembly wheel and assembly base is also separated because it is not effect to each other. At last process "assembly axial " has to be combined because wheel frame and base fame has to assembly together. New lay out is shown next page.

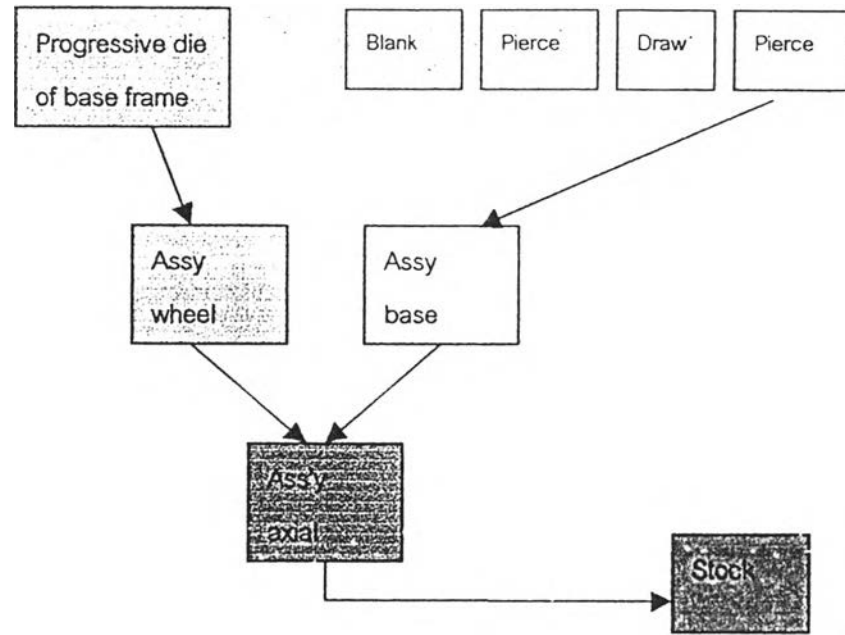


Figure 5.9 New line lay out

5.4 The disadvantages of progressive die replacement and effects

- Man power skill

Man power skill needs to be up grade of knowledge in operating and maintenance

- Maintenance increase

Maintenance is slightly increase in term of spare part and equipment used

- Initial investment

As the replacement, the company need to investment and manage it properly

5.8 The comparison

The comparison in the case study is to summarize in term of comparison classified into 3 main items.

1. Engineering technique
 - 1.1 Machine and equipment
 - 1.2 Plant lay out
 - 1.3 Process flow
 - 1.4 Capability (output)

2. Management
 - 2.1 Direct labor
 - 2.2 Indirect labor
 - 2.2.1 Operators
 - 2.2.2 Staff

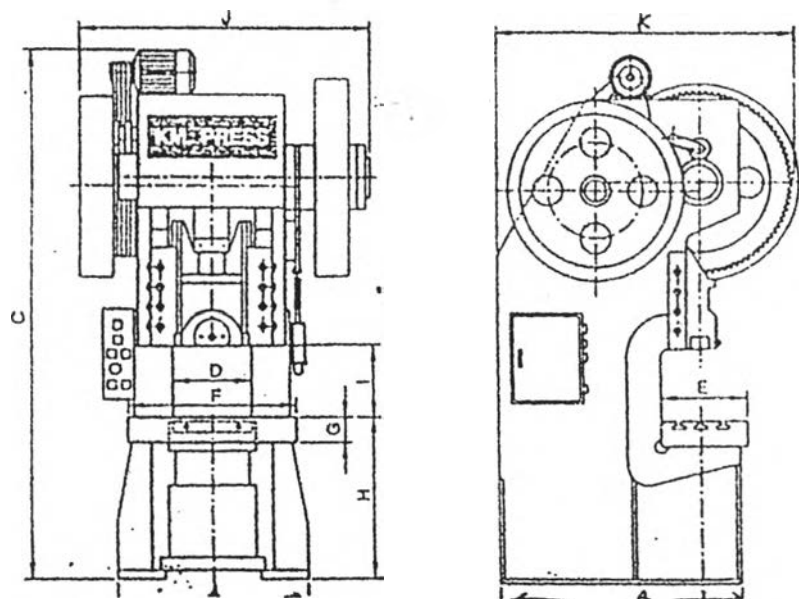
3. Finance
 - 3.1 Investment cost
 - 3.2 Operating cost

1.1 The comparison of machine and equipment

● Machine Single die

Machine specification

● Capacity(tons)	60
● Crank shaft (mm.)	125
● Stroke Length (mm.)	112
● Slide adjustment(mm.)	50
● Die height(mm.)	250-200
● Table areas(mm.)	450-750
● Stroke per minute(S.P.M)	38
● Main motor(HP)	7.5
● Weight (kg.)	2875
● Dimension(mm.)	
	A= 900
	B=850
	C= 2250
	D=375
	E= 450
	F=750
	G= 100
	H=700
	I =350
	J=1225
	K=1275



Specification is quoted from appendix 1

Figure 5.10 Machine specification of single die

● Machine

Machine specification

Progressive die

- Capacity(tons) 80
- Crank shaft (mm.) 150
- Stroke Length (mm.) 125
- Slide adjustment(mm.) 50
- Die height(mm.) 325-275
- Table areas(mm.) 500-800
- Stroke per minute(S.P.M) 30
- Main motor(HP) 7.5
- Weight (kg.) 5200
- Dimension(mm.)

A= 1200

B=975

C= 2525

D=450

E= 500

F=800

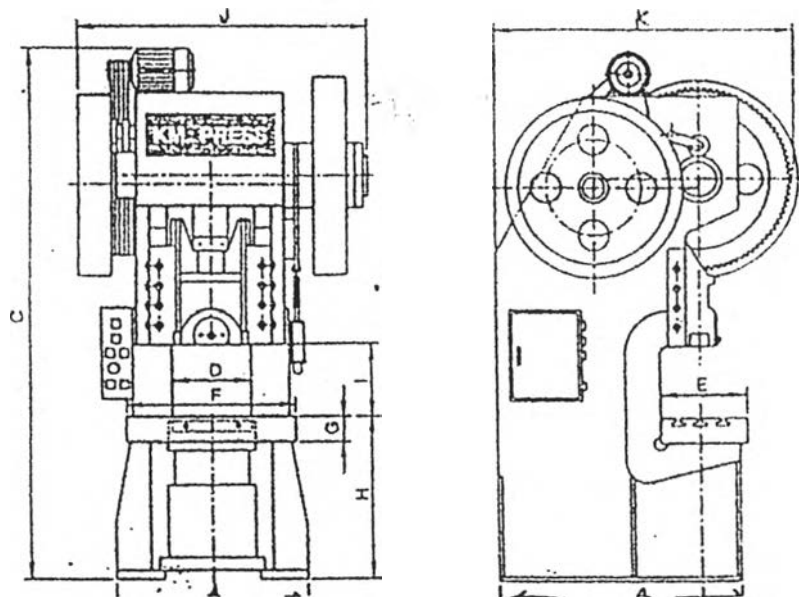
G= 125

H=725

I = 450

J=1350

K=1400



Specification is quoted from appendix 1

Figure 5.11 Machine specification of progressive die

The comparison of machine

Machine for single die and progressive die has generally the same types which is a motor crank shaft press machine operated by electric Pneumatic. this type of machine is normally use in press working product because it give a precision and steady force but it needs to apply oil regularly as indicated in regulator unit. The machine is operated by foot, so it is safe in case of accident occur.

However , there are a few differences on the machine used for this 2 dies. For example, first, progressive die needs a little more capacity than single die because total force is applied on a whole series of die at a time while in single die, force is applied only on 1 die. The capacity for this progressive die should be not less than 80 tons. Second, progressive die needs more table area than single die's because the size of progressive die is normally longer than single die and allow space for air feeder mounted on it.

- Equipments

	Single die	Progressive die
1 . Air Feeder	N	Y
● Maximum width(mm.)		60
● Maximum length(mm.)		70
● Thickness of material(mm.)		0.8
● Air pressure(kg/sq.m.)		4.5
● Feeding speed(s.p.m)		200
● Fixed clamp force(kg.)		30
● Movable clamp force(kg.)		53
● Tension(mm.)		16.5
● Air consumption		32
● Weight including tools(kg.)		9.8

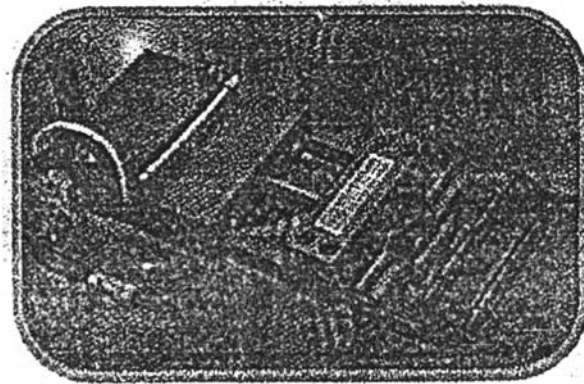


Figure 4.13 Air feeder

Air feeder is needed for feeding a roll sheet into progressive die to perform task in the right manner automatically. Air feeder is normally mounted on machine table to link sheet metal from uncoiler machine to feed automatically to die. Without this equipment, metal can not move in step. There is no people involved in this stage. In single die ,air feeder does not need because part is loaded by operator.

2. Uncoiler machine

	Single die	Progressive die
Uncoiler machine	N	Y
Specification		
● Maximum material width(mm.)		300
● Material thickness(mm.)		0.6-6
● Coil weight (kgf.)		2000
● Speed of feed(m/min)		15
● Material weight		300
● Machine weight		390
● Machine dimension(m.)		1.6x0.6x1.4

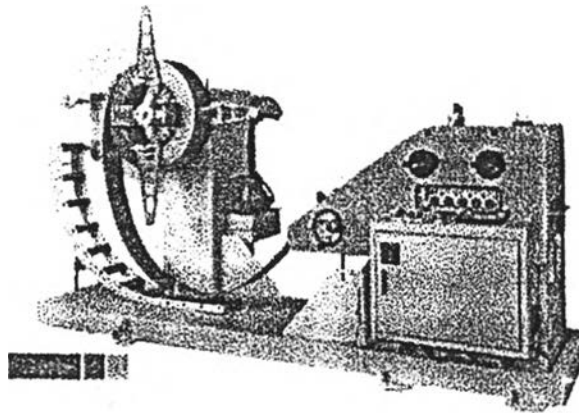


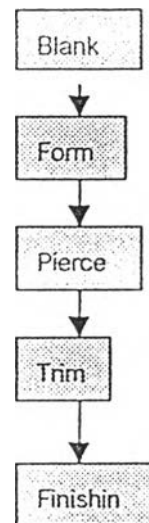
Figure 4.14 Uncoiler machine

Uncoiler machine is a machine to strengthen a roll sheet to be a strength sheet to be ready to feed in progressive die. Without this machine, sheet can not be fed in to die because it comes in a roll shape. Some uncoiler machine comes with air feeder(built in air feeder) but some is separate. In single die, part comes in sheet piece. It does not come in roll sheet like progressive die's, therefore uncoiler machine does not need.

- The comparison on process

1. Single die

Wheel Frame

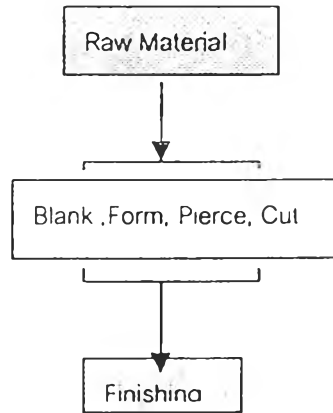


DESCRIPTION	DISTANCE (m)	cycle time (sec)
Material transported	7	120.00
Blanking		3.10
transport	1	62.00
Forming		4.20
transport	1	72.00
pierce hole		2.80
transport	1	54.00
trimming		3.90
total	10	322

Table 4.1 Process Flow Chart and Data of Single die

2. Progressive die

Wheel frame



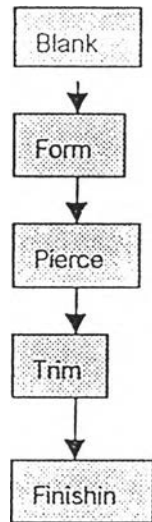
DESCRIPTION	DISTANCE (m)	cycle time (sec)
Material transported	7	120
Blank	-	2
Form	-	2
Pierce	-	2
trim	-	2
Total	7	128

Table 4.2 Process Flow Chart and Data of Progressive die

■ The comparison on process

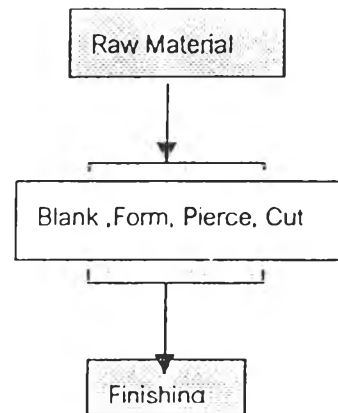
1. Single die

Wheel Frame



2. Progressive die

Wheel frame



DESCRIPTION	DISTANCE (m)	cycle time (sec)
Material transported	7	120.00
Blanking		3.10
transport	1	62.00
Forming		4.20
transport	1	72.00
pierce hole		2.80
transport	1	54.00
trimming		3.90
total	10	322

DESCRIPTION	DISTANCE (m)	cycle time (sec)
Material transported	7	120
Blank	-	2
Form	-	2
Pierce	-	2
trim	-	2
Total	7	128

Table 4.3 The comparison of Process Flow Chart and data of 2 types of dies

Flow chart shows that part from progressive die has less travel stage than single die therefore it is short distance . That means progressive die is able to eliminate work in-process and transportation . cycle time of each process of progressive die is shorter and consistence because in progressive die, has no operator doing load-unload part.

ต้นฉบับ หน้าขาดหาย

ต้นฉบับ หน้าขาดหาย

2. Progressive die

Area do takes up about 50 meters which are 10 meters long and 4.5 meters wide.

It includes

- Machine 80tons and feeder for progressive die
- area for uncoiler machine
- area for 1 operator
- area for raw material
- area for output product
- are for die shelf

therefore, progressive die save up 100square meters free space more than single die's.

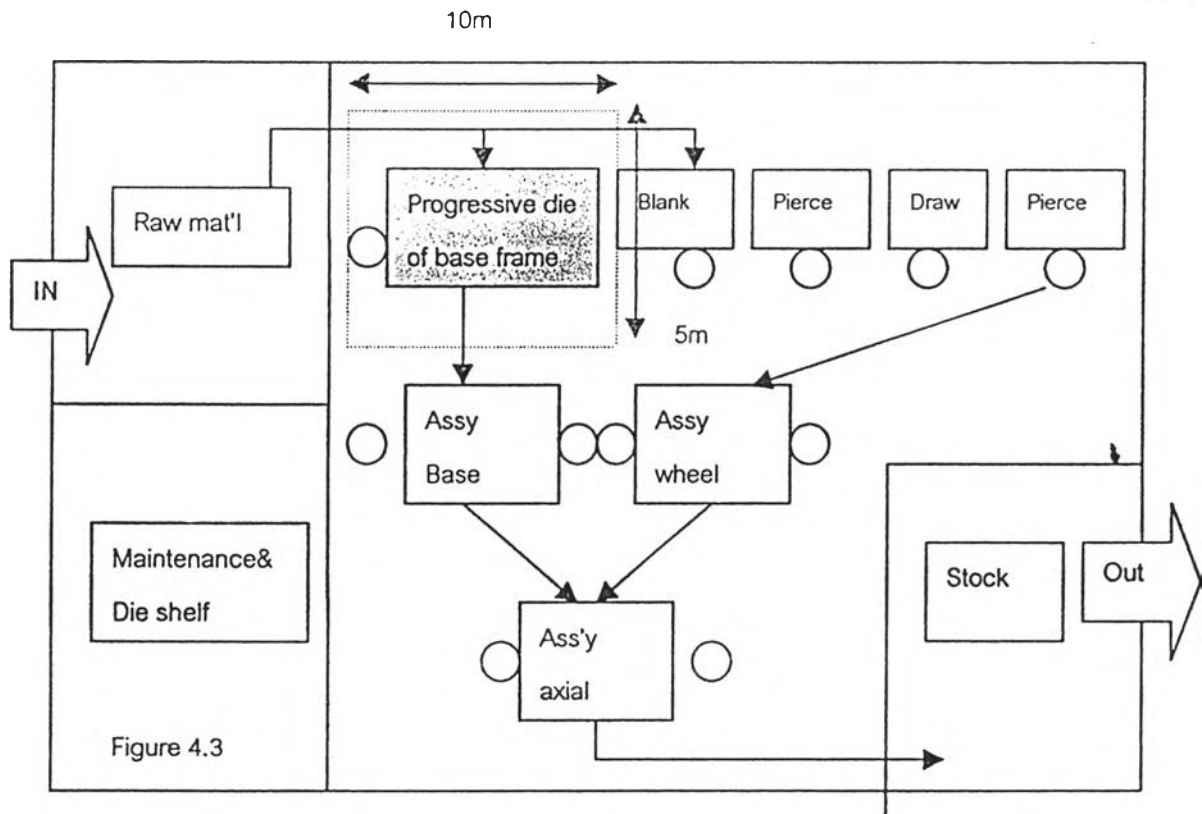


Figure 4.15 Lay out of tentative progressive die area occupancy

1. Single die

Area or space occupied by single die do takes up about 150 square meters in which 20 m long and 7.5m wide.

The area occupied is consisted of

- area for 4 machines for 4 operation die which are blank, form, pierce, trim
- area for raw material
- area for work in process in each operation
- area for operator doing work and movement
- area for finished part(stock)
- area for machine gap
- area for 4 die shelf
- area for pathway

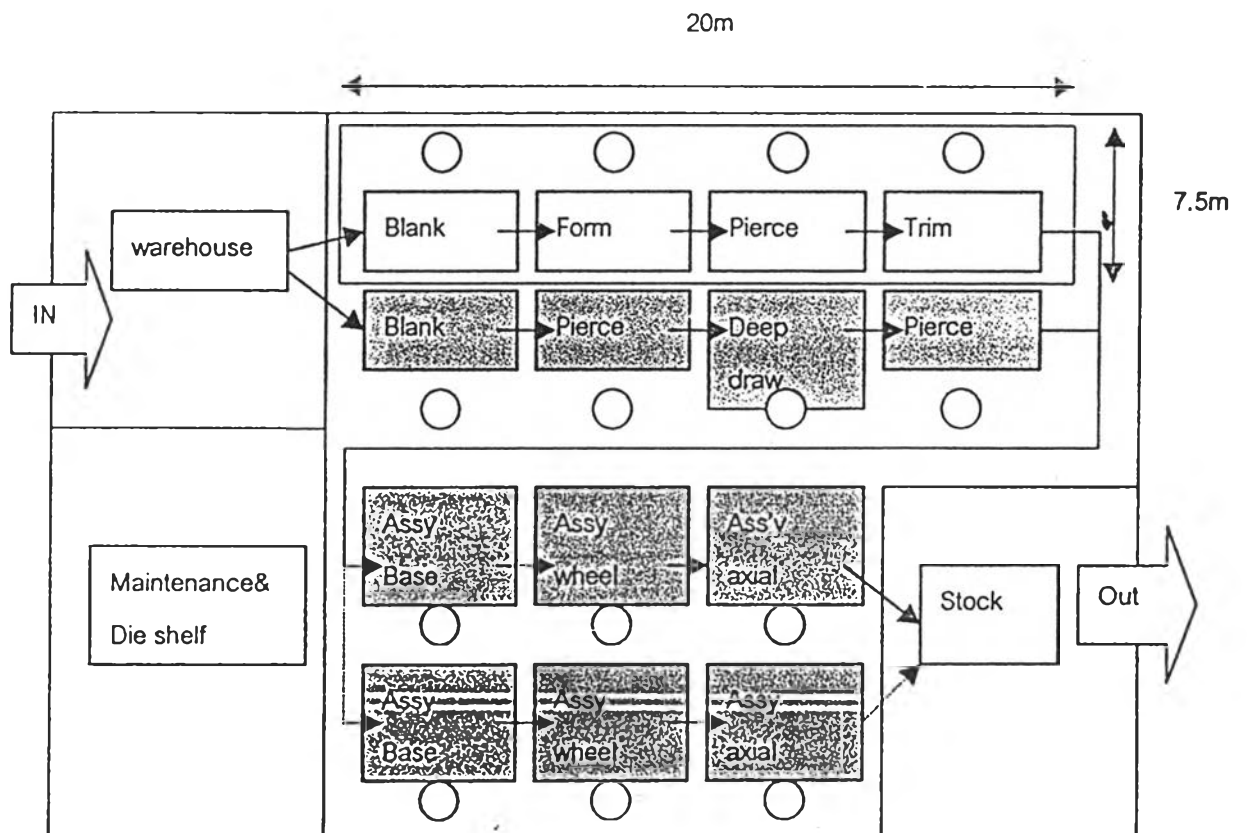
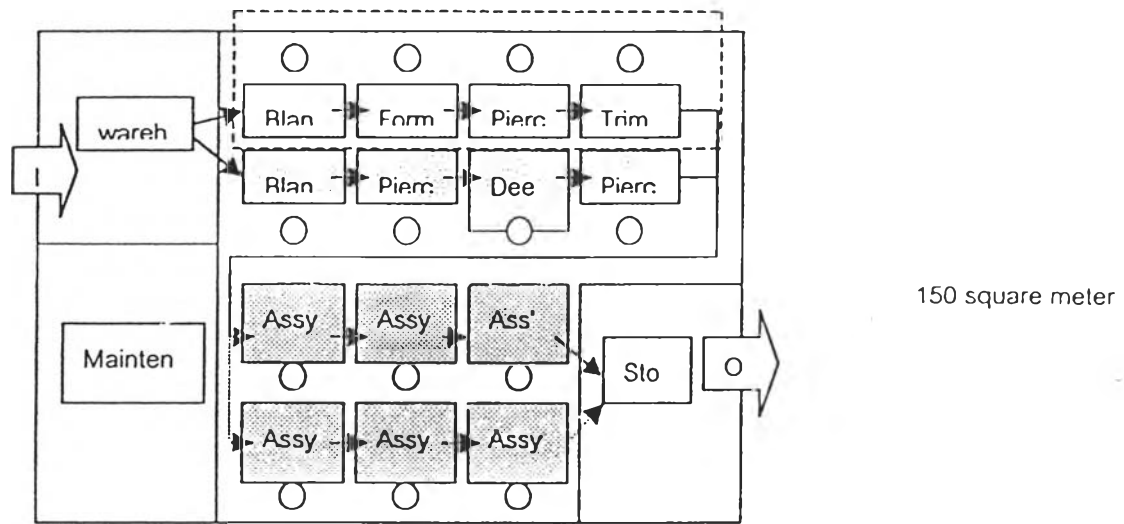


Figure 4.16 Lay out of single die area occupancy

■ The comparison of plant layout

1. Single die

Area occupied



4. Progressive die

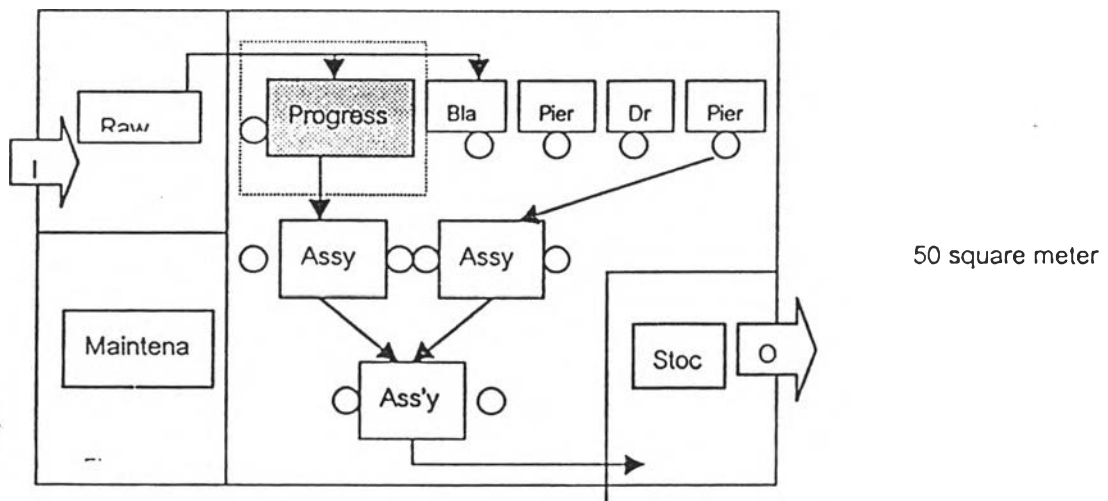


Figure 4.17 The comparison of area occupancy of 2 dies

Area occupied by single die in wheel frame line is represented by dash line. it is about 150 sqr m. After replacement by progressive die(represent in dash line) ,it reduce to 50 sqr. m.

ต้นฉบับ หน้าขาดหาย