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This is to certify that

RUDI KURNIAWAN ARIEF

has participated in the

CONFERENCE ON INNOVATION IN TECHNOLOGY AND ENGINEERING SCIENCE (CITES 2018)

as **Presenter**

November 8th – 9th, 2018 in Padang, Indonesia

RECTOR OF UNIVERSITAS ANDALAS

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CHAIRMAN

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PROGRAM BOOK

THE 1ST CONFERENCE ON INNOVATION IN TECHNOLOGY AND ENGINEERING SCIENCE

Grand Inna Padang Hotel, West Sumatera, Indonesia
November 8th - 9th, 2018

Supported by

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WELCOME MESSAGE

We are very pleased to welcome all of the participants to The 1st Conference on Innovation in Technology and Engineering Science (CITES) held on November 8th -10th, 2018 in Padang, West Sumatera, Indonesia.This meeting is organized by the Faculty of Engineering Universitas Andalas and supported by Universitas Andalas.We believe that this event will never come to happen without your participation and contribution.

This meeting is to bring indonesian scientists, engineers, technical experts, and early-career scientists as well as theirs peers from all around the world to discuss current development and important issues on innovation of technology and engineering science. It is also designed as virtue to exchange knowledges and build strong networks among Indonesian researchers and their International peers.

There are more than 130 scientific talks comprise of 6 plenary lectures. In addition to Indonesian communities, this meeting also attracts International scientists from 3 other countries, which are Malaysia, Singapore and Thailand. There is alsoa collaboration research between Indonesian researchers with UK. The International diversity and the broad spectrum of the participant origins and research fields play an important role of the success of this meeting.

Finally, we wish to express our sincere appreciation to all of the participants for theirs valuable contributions and also to the organizer for their excellent works. We also would like to acknowledge sponsors contribution. Hopefully, you will have a fruitful discussion with your colleagues and enjoy a pleasant stay in Padang.

Prof. Dr. Eng. Gunawarman
Conference Chair

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Parallel Sessions I

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Room-1 : Sumpur
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Session Chair : Dr. Eng. Dicky Fatrias

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Abstracts

Parallel Sessions I

Date : November 8, 2018 (Thursday)
Time : 13.30 – 15.00

Room-1	:	Sumpur
Topics	:	Industrial Engineering
Session Chair	:	Dr. Eng. Dicky Fatrias

ID 440

Setup Time Efficiencies of Quick Die Change System in Metal Stamping Process

Rudi Kurniawan Arief [1], Qomarotun Nurlaila [2]
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The rapid developing of technology today has forced manufacturing companies to widely expands their business and production abilities. Efficiencies in all aspects must be taken to maximized production capacity and reduce waste to survive. Lean's SMED technique is one of waste reduction method that usually used in manufacturing companies and specifically called the Quick Die Change (QDC) for metal stamping companies. But some research related to QDC only discuss about the setup tools and operator movement during setup and process. This research observed the setup process of the die construction that has been modify to be able to reduce the setup time and other time wasted activities. This QDC die construction could save setup time by 60% compared to conventional die and could do more if carefully planned. Research conducted in an automotive spare parts maker in Jakarta wider region that already use this QDC die in their production line.

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1. Introduction

Many ways and methods are using to reducing the waste in manufacturing process. One of the famous lean method in metal stamping companies is the Single Minute Exchange of Die (SMED). SMED reduced waste by converting a rapid and efficient way from running current product to running next product. The SMED has become a popular method due to increasing of product variability, reducing of product lifecycle and inventories [1].

Today's trend is that costumer require a product that less similarity with other costumers, this forced the company to provide large diversity of products. This product's diversities require company to be able to produce smaller production quantities that means also required frequent tool changes. Means the company must be able to reduce setup times and eliminate unnecessary operator's activities. This means that the manufacturing companies must be able to have strong focus in process innovation [2].

The focus on reducing no productive activities becoming a critical element in lean manufacturing. One of the SMED's improvement method is by eliminating the waste of activities during tooling set up by reducing the setup time to less than 10 minutes. It also helps reducing the inventory problems as well [3]. In metal stamping company, term of Single Minute Exchange Die (SMED) called by Quick Die Change (QDC). Despite the huge advantages of QDCS to gain more efficiencies, this system remains un touch and very less company use it. This paper is to find out why less company using this system and try to calculate and shows the QDCS advantages by observing and experimental activities.

2. The SMED of Metal Stamping Die.

The concept of QDC is to minimized operator's activities during internal setup by standardized the activities and work sequences. QDC often associated with machine and die accessories to help reducing setup time such as hydraulic clamps, die roller, die cart, bolster extension, etc. Other is related to reducing the setup activities such as; clearing die area, changeover of dies, clamping, setting, etc. [4]. All of those tools and activities could reduce time wasted up to 75,9% and 50% of manpower [5].

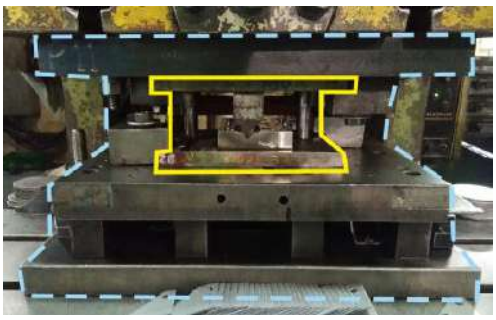


Figure 1. QDCS Die Construction

Figure 2. Conventional Die Construction

3. The Concept of Quick Die Change System

The SMED method was invented by Shigeo Shingo comes from the inefficient process occurred in Mazda production plant in late 1950. The invented method increased the production capacity by 40%. [6]. The SMED method is based on theory and years of practical experimentation by Shigeo and can be applied in any factory to any machine. In 2002 Fumio Yamaguchi has developed and share for Philippines stamping industries a new SMED tools called Quick Die Change System (QDCS).

QDCS is the development of die's construction and design in order to gain further efforts of reducing waste in all aspects. Even though This QDCS could reduce manufacturing costs, setup time and also storage area, this system rarely discussed and implemented in stamping company. During research and interview with several stamping company in Jakarta region, only 2 company familiar with this tool and 1 company implements QDCS. The QDCS concept is to breakdown a conventional

die into two main assembly, the housing unit (QDCH) and the die unit (QDCD) [7]. This QDCD constructions could reduce manufacturing costs, setup time and also storage area.

4. Research Methods

This research using direct observation and interview data gathering methods. Focused group discussion (FGD) conducted with the Managerial level and floor operational level to gain more information regarding the utilization and disadvantages of QDCS in the company. Experiment conducted in production area of PT. SPI by filming dan counting activities time of setup process of conventional and QDCS. The activities were observed while operators in charge.

5. Focused Group Discussion

5.1 Aim of FGD

FGD held for two focus groups in August 2018 involving employee of PT. Sanwa Presswork Indonesia represented the company that using QDC system in their production line. The Participants came from all High managerial level, mid level and shop floor level. The discussion was designed to gather information from the students in regard to the following outcomes:

a. To understand how effective QDC system in production activities.
b. To understand the cost efficiency affected by QDC system.
c. To understand operator's satisfaction as user of QDC system.

5.2 Participant

1. Head of Departments : Manager of Quality Control, Engineering, Production, Production Planing Control (PPC) and Operational Director (5 persons).
2 :Production personel : Supervisor, leader, 2 operator (4 persons).

5.3 Perspectives

1. HoD Perspectives :
   a. How does the performance of this QDC system
   b. Is it difficult to manufacture
   c. How does manufacturing cost of this QDC
   d. Does it difficult to handle/ require large spaces
   e. Any new supporting machine/vehicle system needs for this QDC
   f. How does it's production result

2. Production personel Perspectives :
   a. Is it difficult to install
   b. Does it need large storages
   c. Does it need forklift or hand lifter during installation
   d. Does it produce good product
   e. How does the performance of this QDC system
   f. Does this QDC help to make production faster

5.4 Findings

1. HoD Outcomes :
   a. The performance of this QDC system is good
   b. Design, manufacturing and manintenance proces is easy dan save a lot of time.
   c. Manufacturing cost of this QDC is very cheap, could be 25%-50% lower depends on difficulties
   d. Very less storage and spaces required

e. In general, QDC can be carried by hand but sometimes operators use hand lifter device to carry it 2 or 4 units at once.
f. The result Ok, no different than the conventional die

2. Production personel Outcomes :
   a. It so easy to install, if the accessories complete and new it even faster
   b. Only use small rack behind the machine no need to waste time by a long walk.
   c. Just carry by hand.
   d. Same quality as conventional die
   e. Even QDC can help a lot but overall performance not so significant
   f. In single product production it is faster, but not for overall production schedule.

6. The Setup Time Analysis

The QDCS could decrease set up time due to the small and lightweight of the Die Unit (QDCD) construction. The QDCD can be carried by hand by one person easily and quickly. This reduced waiting time of lifting devices that may be in use at the same time by another die. The small size of QDCD and the integration system with the Housing Unit (QDCH) also reduced the setup time.

The observation conducted by comparing the setup time of conventional die and QDCD from picking up die, setup and dismantle of booth of die unit. 6 steps of setup sequences were observing from Conventional Die to QDCD.

6.1 Conventional Die Setup Time

First step is to pick up the die from storage. Because of big and heavy construction of conventional die, a lifting equipment is required. The storage position is in the next room with distance about 10 Meters from machine. This activity takes about 1,5 minutes. The die then positioned manually above the table to be exact in the center of machine for about 26 second. Setting of machine stroke height for about 9 second. Clamping of conventional die takes about 3,2 minutes before start producing the parts. After production die unclamped for about 2,5 minutes and put back to storage area for about 2 minutes. All of this setup process takes about 10 minutes for conventional die.

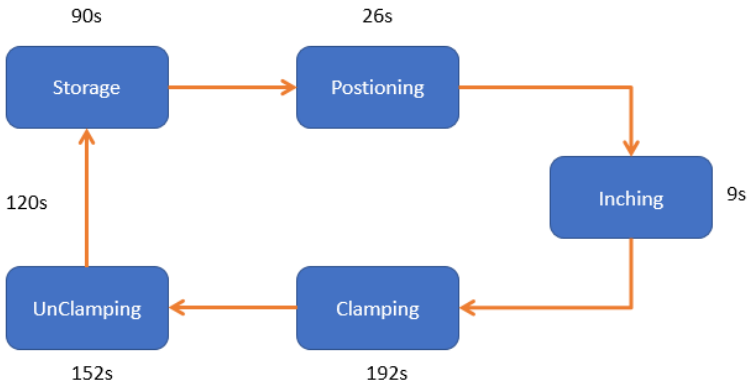


Figure 3. Setup Process Sequence and Time for Conventional Die

6.2 QDCS Setup Time

The storage position of QDCD is in the same room with distance about 1 Meters from machine. The QDCD is light so can be carry by hand that only takes 13 seconds. The QDCD then positioned inside of QDCH without many adjusting efforts because QDCH already provide with rail guide and centering stopper. This activity is done by 5 seconds. Setting of machine stroke height for about 4 seconds.

Clamping of die takes about 1,3 minutes before start producing the parts. After production die unclamped for about 1 minutes and put back to storage area just for 15 second. All of this setup process takes about 3 minutes.

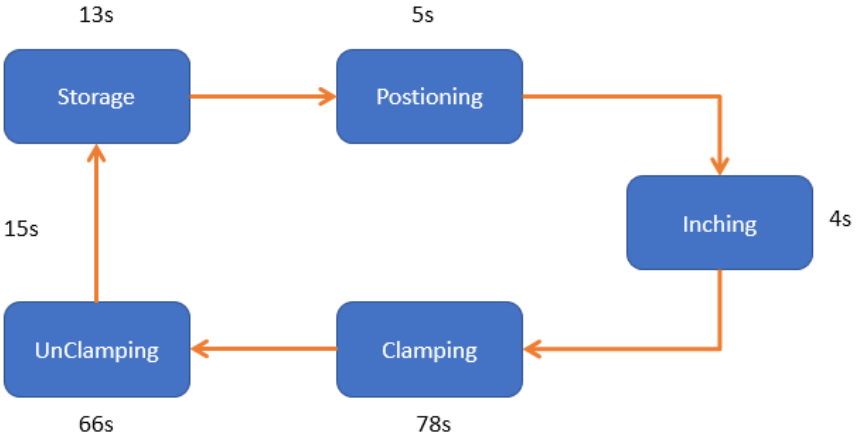


Figure 4. Setup Process Sequence and Time for QDCD

6.3 Setup Time Comparison
The sequence and setup time then compared as the table below.

Table 1. Setup Time Comparison

Activities	QDCD (s)	Conventional Die (s)
Pickup dies	13	90
positioning	5	26
Inching	4	9
Clamping	78	192
Unclamps	66	152
Unload dies	15	120
Total Time	**181**	**589**
	3 Minutes	**9,8 Minutes**

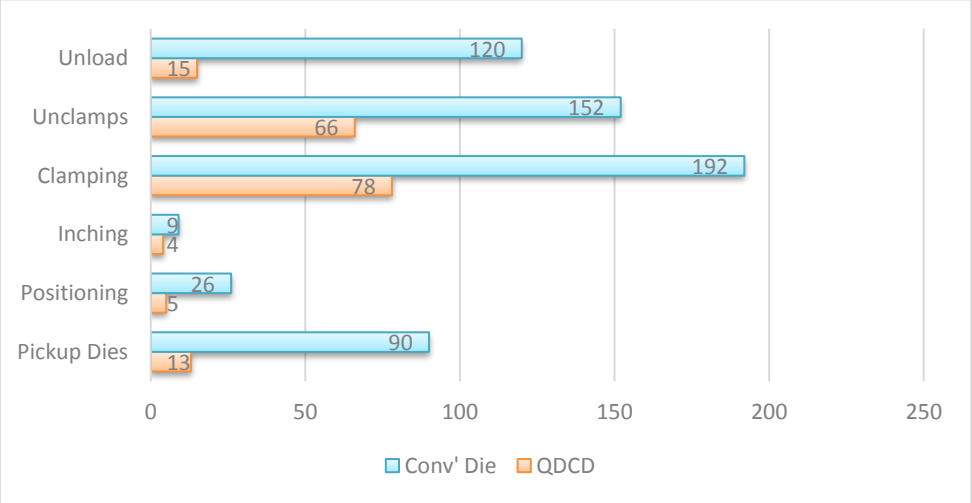
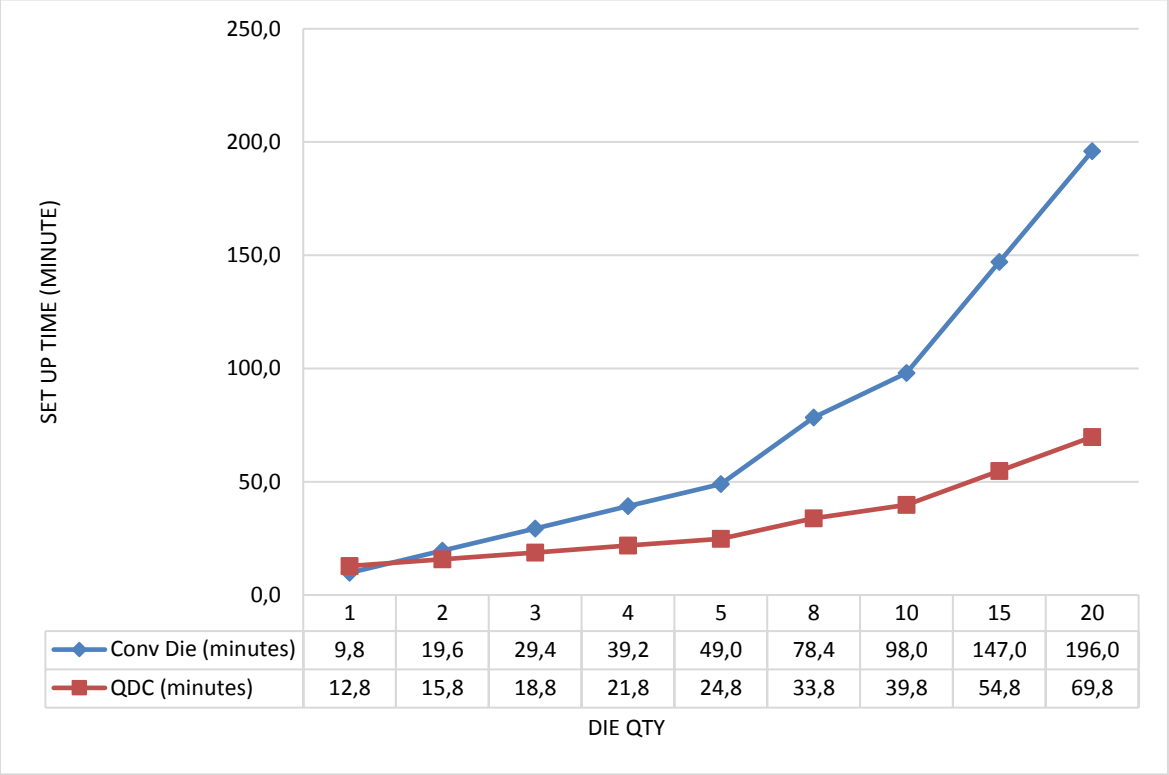


Figure 4. Setup Time Comparison

From observation data, the QDCS could reduced setup time by 69% compared to setup time of the conventional die. But the requirement of QDCH when using the QDCS also becoming a weak point of the QDCS. Table below presented the setup time of QDCS and Conventional Die when operating in some quantity. Setup time for installing Housing Die is assumed to be the same as conventional die.

Table 2. Efficiency Percentages in Setup Time

Number of Die to be Installed Sequentially	Conv' Die (s)	QDCS (s)	Efficiency Percentages QDCS to Conv' Die
1	9,8	12,8	-30,61%
2	19,6	15,8	19,39%
3	29,4	18,8	36,05%
4	39,2	21,8	44,39%
5	49,0	24,8	49,39%
8	78,4	33,8	56,89%
10	98,0	39,8	59,39%
15	147,0	54,8	62,72%
20	196,0	69,8	64,39%



	1	2	3	4	5	8	10	15	20
Conv Die (minutes)	9,8	19,6	29,4	39,2	49,0	78,4	98,0	147,0	196,0
QDC (minutes)	12,8	15,8	18,8	21,8	24,8	33,8	39,8	54,8	69,8

Figure 5. Efficiency Percentages in Setup Time of Sequential Process.

Data above shown the gaps that getting bigger as the quantity of die to be set in sequentially process increased. If single die is used, efficiency of QDCS is lower than Conventional die, because QDC needs 2 components to be installed for the first time which is Housing of Die and the QDCS itself. By the second QDCS, setup time decreased by almost 20% and almost 40% by the fourth QDCS.

It's rarely a company will produced up to 20 die for a day, so if the production team could manage for 8 QDCS for a day in one machine, the time waste can be eliminated more than 56% than when conventional die is used. By more using of QDCS in sequential process, higher time efficiency gained. That means, in order to get the most efficiency of setup time, the production team must be able to plan more sequential process dedicated to QDCS [8]. This system also best choice for low production quantity that required several times of die changing in a day.

7. Analysis & Discussion

Slightly differences found in the perspective of Managerial dan Shop floor level in the performance of QDCS regarding to the advantages of utility. Managerial level in the first group seems quite satisfy with the performance of QDCS where cost, time and storages can be safe without decrease of quality. Shop floor in the group to not satisfy with the performance and time save make by QDCS. They stated that many times lost for installation or setup process because some serial continual need to switch from QDCS to manual, this cause many drawbacks. Other aspects, the opinion of these groups seems to be similar. Observation result show why the differences happens. For some part, sometime needs more than one process, sometime 1st process using conventional die and 2nd process using QDCS then the 3rd process back to conventional die. This case will drop efficiency by 30% (see Table 2). This happens because of miss understanding between engineering in determining the flow process. To have better impact of efficiency effect the decision of manufacturing the QDC must be made and included since the early flow process design, so die designer may also decide whether to do design this system or not. In process planning stage the PPC team must decide the continual process that use the QDCS

system with number of sequences QDCS in order to maximize the efficiency effort. In order to gain maximum efficiency, company must pay more detail since the early stage of flow process design to production planning in mass production stage in order to meet the efficiency mention above.

8. Conclusions

The QDCS does have good efficiency impact in reducing time waste in setup time. Depending on how much the exchange in the process, the QDCS decreased the setup time waste up to 60% of the setup die wasted on Conventional die. This efficiency can reach by optimization of setting up a good production planning sequences of die production, and also suitable for low production capacity with high variant of products.

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