



Production Line Balancing for Process Improvement in A6 Line

Thamaruk Kunkate

Assistant Professor Uttapol Smutkupt,Ph.D

Industrial Engineering, Faculty of Engineering, Chiang Mai University

Introduction



DAIKIN INDUSTRIES (THAILAND) LTD

Manufacturer of commercial air conditioning

Air conditioner 2 types

- 1) Room air conditioner (for house)
- 2) Package air conditioner (for office)



Objective

Up percent line balancing from 85.04 % to 90.00 %

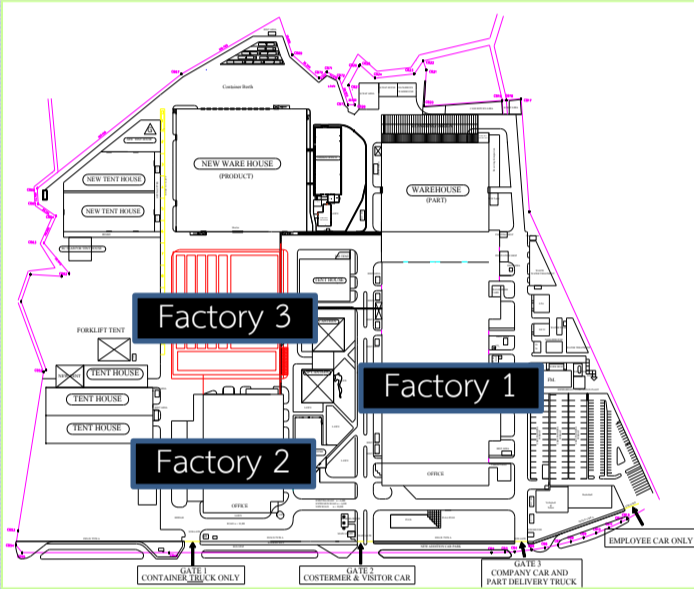
Learning load simulation

In 2021,  
Production planning of A6 line increasing.  
Open operation 2 group 2 shift (high cost)  
So, company need to best worth therefore learning A6 line to find a problem and try to improve aspects can up capacity for line shift from A2 line

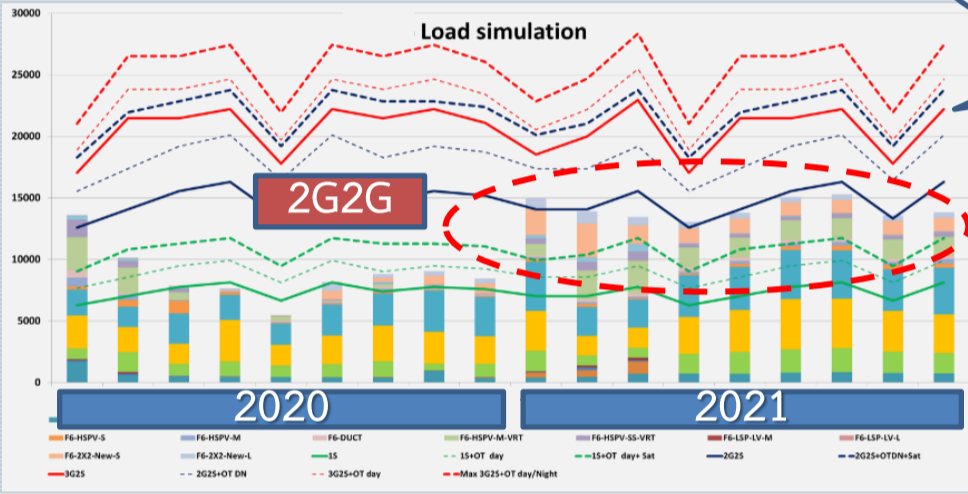
Select A6 line for learn and improvement

Working procedure

1. Learning details in factory



2.Select production line for improvement



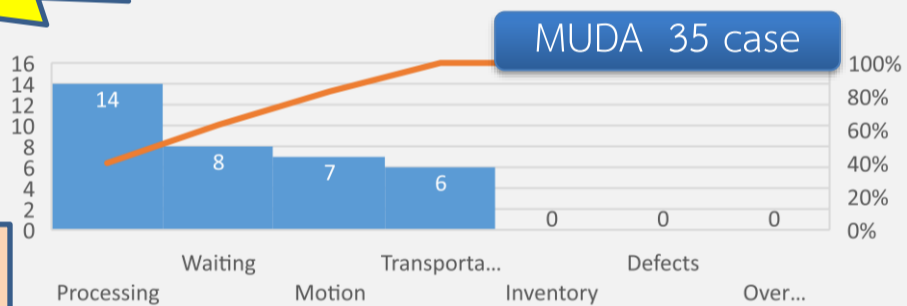
5.Analysis and find cause of MUDA

Analysis data from standard time compare takt time and patrol production line for observe working problem

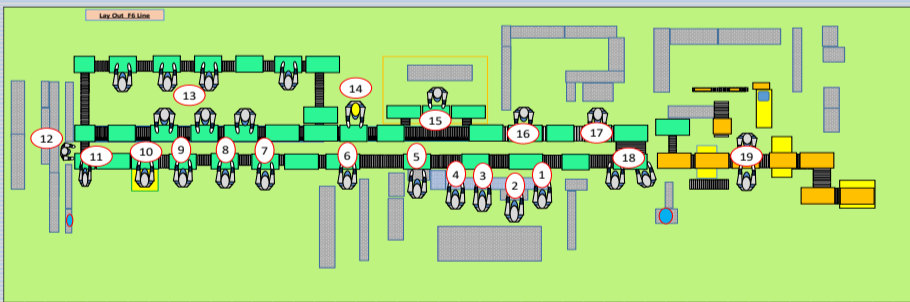
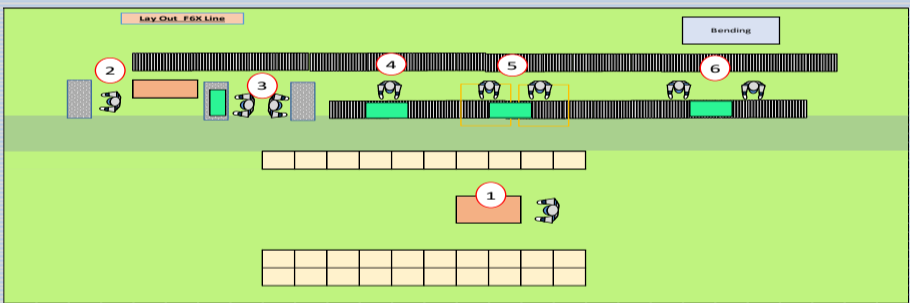
Station (process)	Problem	Type MUDA	Cause	Idea improvement	Result (forecast)
-------------------	---------	-----------	-------	------------------	-------------------

MUDA in A6 line

Cause of MUDA in A6 Line



3.Learning lay out and process in line



Each model is different process and element

4.Time study

Record time each group 5 times

Number of cycle to be timed for confirm to trust of data

Add record time

Assessment rating of working

Find normal time

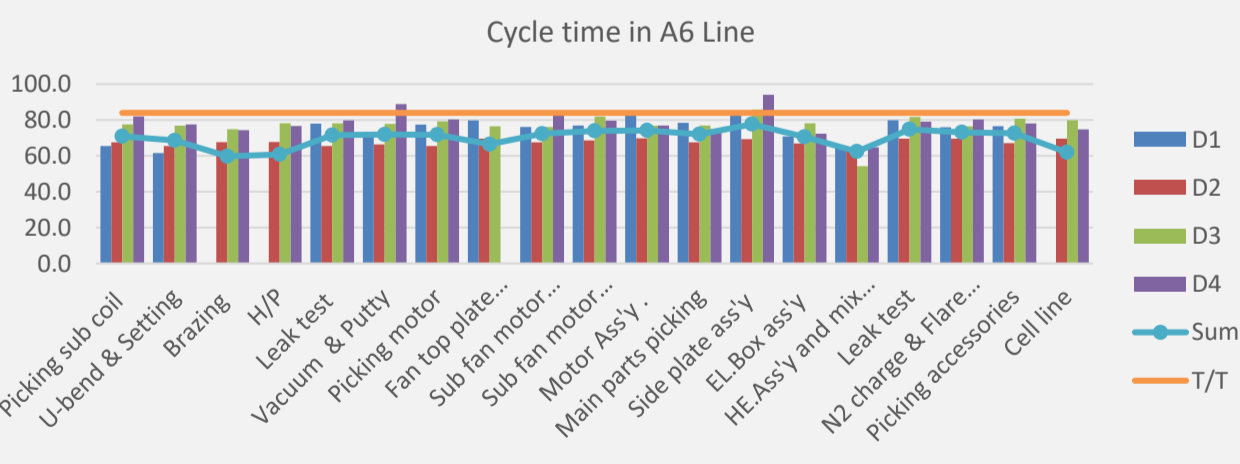
Find standard time

Find actual standard time of each model and summary actual standard time of A6 line

7.Time study after improvement

Find standard time of each model after improvement and summary standard time of A6 line

% Line balance


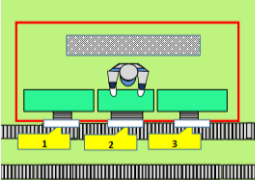
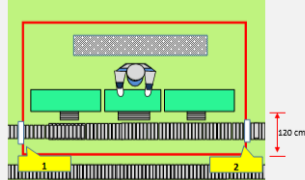


6.Production line balancing and improvement process

Improvement process for all model in A6 line

Example

Process high volt and running test for model D1

Line	A6	Process Name	High volt and running test																												
	Before	 <table><thead><tr><th colspan="2">Test room</th></tr></thead><tbody><tr><td>Open door</td><td>2</td></tr><tr><td>Move in</td><td>6</td></tr><tr><td>Close door</td><td>2</td></tr><tr><td>Test</td><td>75</td></tr><tr><td>Open door</td><td>2</td></tr><tr><td>Move out</td><td>6</td></tr><tr><td>Close door</td><td>2</td></tr><tr><td></td><td>90</td></tr></tbody></table>	Test room		Open door	2	Move in	6	Close door	2	Test	75	Open door	2	Move out	6	Close door	2		90	 <table><thead><tr><th colspan="2">Test room</th></tr></thead><tbody><tr><td>Move in</td><td>6</td></tr><tr><td>Test</td><td>75</td></tr><tr><td>Move out</td><td>6</td></tr><tr><td></td><td>87</td></tr></tbody></table>	Test room		Move in	6	Test	75	Move out	6		87
	Test room																														
	Open door	2																													
	Move in	6																													
	Close door	2																													
	Test	75																													
Open door	2																														
Move out	6																														
Close door	2																														
	90																														
Test room																															
Move in	6																														
Test	75																														
Move out	6																														
	87																														
Product is inspect from PI check to test room for process test high volt and running test products moving test room is 3 way (as picture) In test room is 1 operator and working station 3 stations.		Improvement																													
		Design test room in front add 120 cm. astride conveyor reduce door from 3 doors -> 2 doors for reduce moving time of products																													
Problem and Cause																															
Problem		Result																													
Product is waiting test room		Time for in-out test room reduce 8 sec./units																													
Cause		Eliminate MUDA of waiting																													
Waiting door test room open-close (open-close when product in-out)																															

Summary and result

No.	Detail	Before	After	Diff	Percent (%)
1	PRODUCTIONS ( UNITS )	328	416	88	26.82
2	CYCLE TIME ( SEC. )	87.9	69.3	-18.6	21.16
3	MUDA ( CASE )	35	2	-33	94.28
4	%Line balance	84.03	92.04	8.01	9.53
5	PRODUCTIVITY	126.82 %			