Introduction to Standardized Work and TWI

TPS Model

Marek Piatkowski

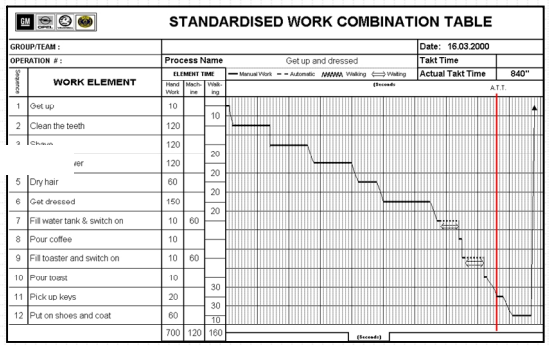
What is Standardized Work?

- Standardized Work is the best know ***method*** for manufacturing products at a production worksite.
- The principle behind the Standardized Work is to perform efficient production, in a consecutive sequence, by **focusing on operator's movements** and systematically combining work tasks.

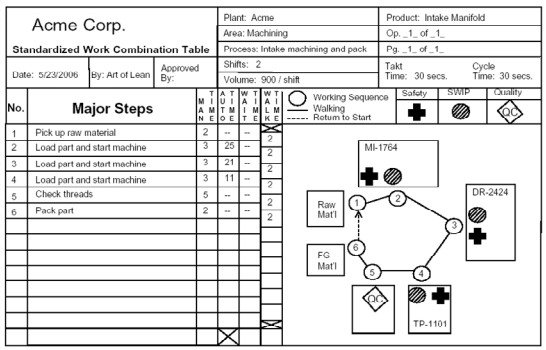
Process Capability Operator Time Observations		Line / Section		Date		Part Description		Created by:
#	Work Elements (Working or Walking - Waiting is NOT a work element)	Total Cycle Times #1	#2	#3	#4	#5	Type of Work*	Best Time**	Notes
1	Load cross bar	4.5	3.5	5.5	7.0	4.5	IW	4.5	A lot of walking
2	Load C bracket	6.5	4.5	5.5	5.5		IW	5.5	A lot of walking
3	Insert pins and screws	7.0	6.0	7.0	6.0		VA	6.0	Using both hands
4	Start the machine	1.0	1.0	1.0	1.0		IW	1.0	
x	Waiting for machine to cycle	7.0	7.0	7.0	7.0		W	7.0	Waiting - 7 seconds
5	Unload C bracket	4.5	10.0	4.5	4.5		IW	4.5	Walk and inspect
6	Unload cross bar	5.0	5.0	4.0	4.0		IW	4.0	Walk and inspect
	Total	25.5	30.0	27.5	28.0			25.5	

* Type of work includes one of the three: VA, IW or Waste
** Best time = lowest repeatable time that can be performed on regular basis (Standard operating time)

1. Process Capacity Sheet



2. Standard Work Combination Table

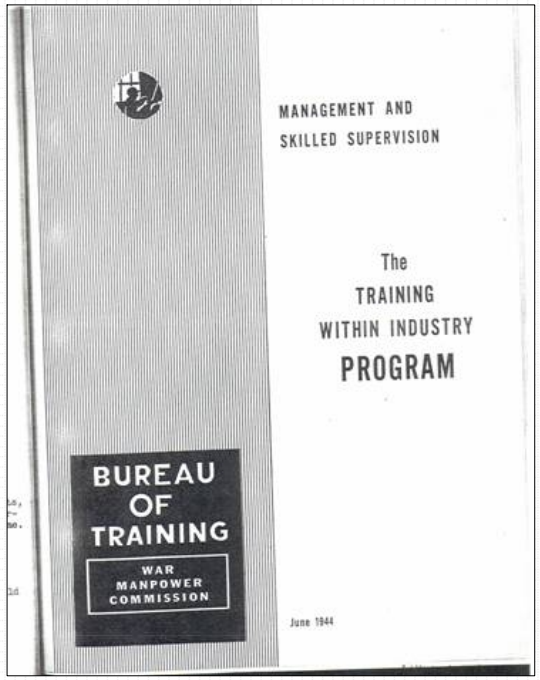


3. Standard Work Chart

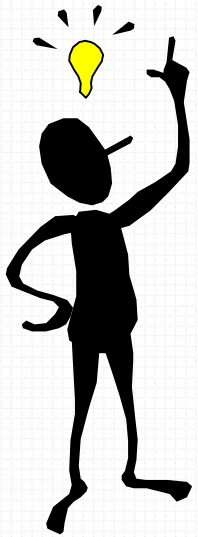
What is TWI – Training within Industry?

Training Program – 3 Js

- ***Job Instruction*** gives the supervisor practice in how to train operators on new jobs.
- ***Job Methods*** helps the supervisor to simplify and improve methods of doing a job.
- ***Job Relations*** gives the supervisor practice in how to promote teamwork.

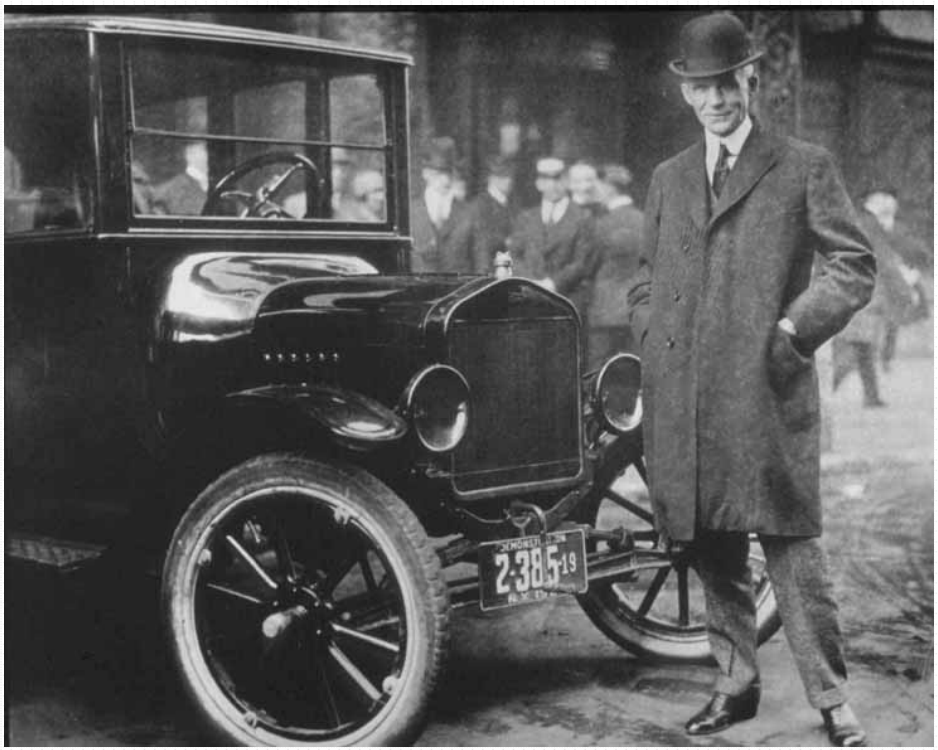


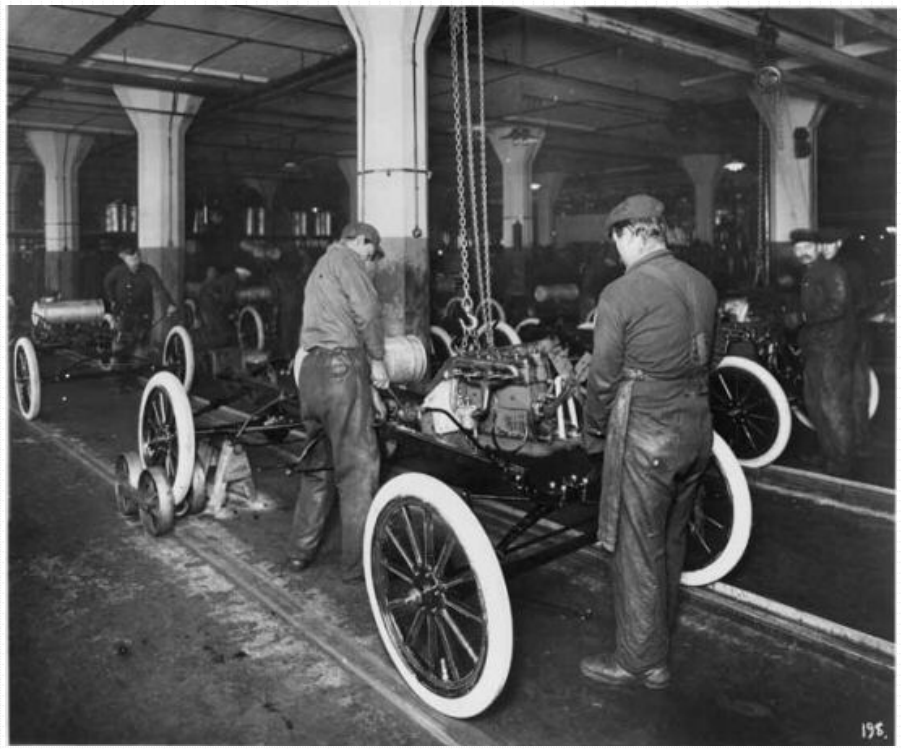
History of Standardized Work and TWI



Henry Ford introduces a concept of an Assembly Line and Mass Production

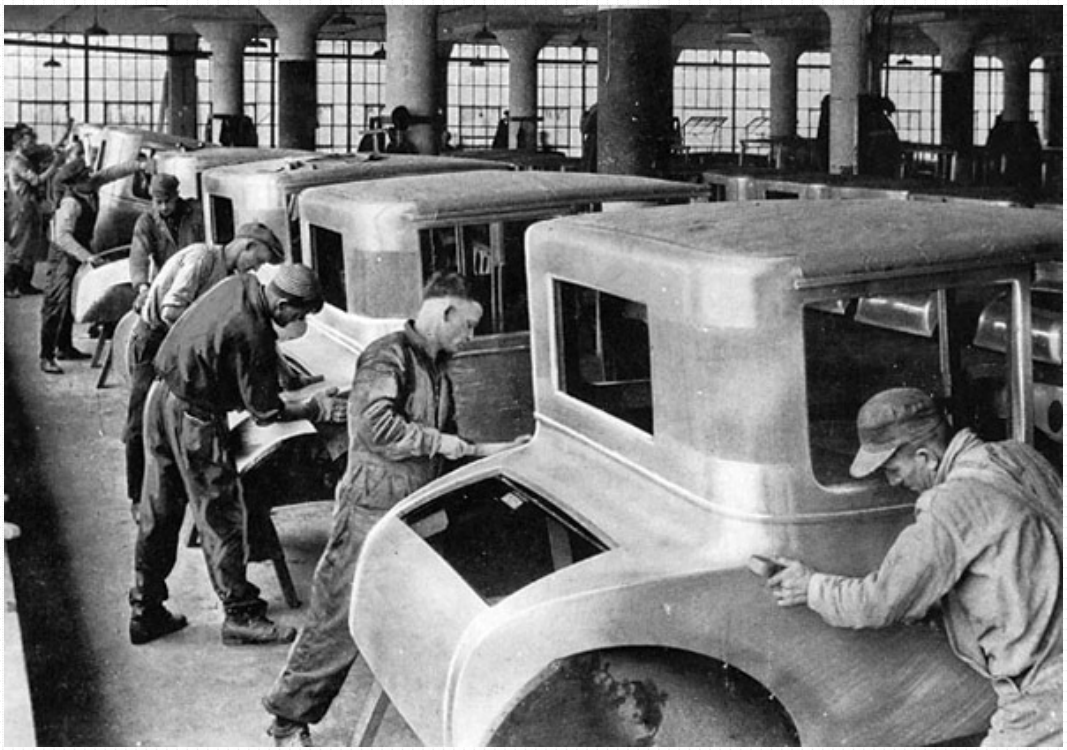
1913

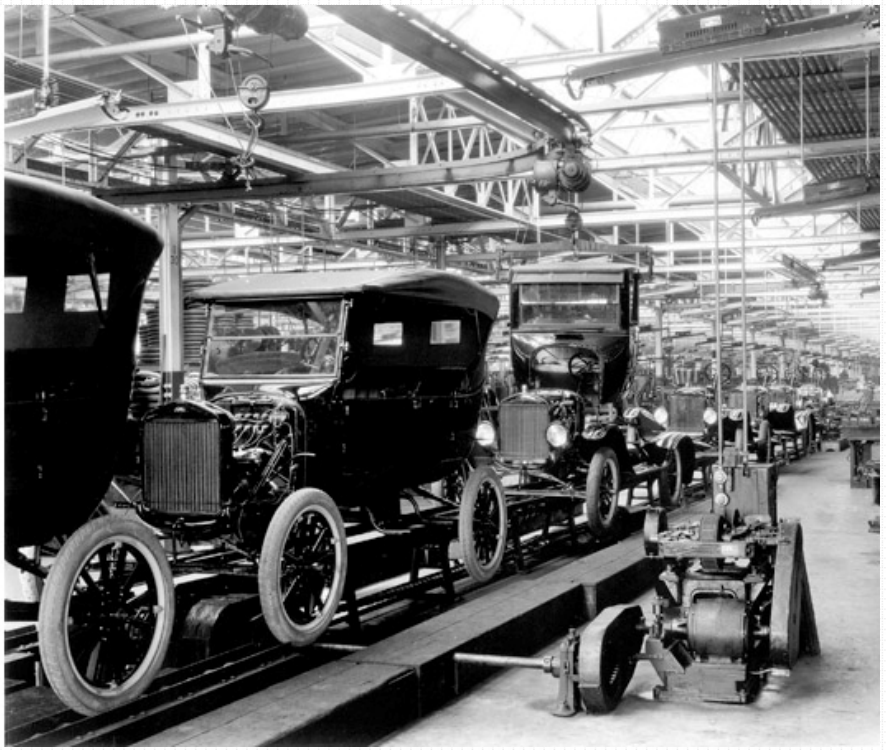





Ford
THE UNIVERSAL CAR
Buy It Because
It's a Better Car
Model T
Touring Car
f.o.b. Ford,
Ontario
$650
Get particulars from Ford Motor Co. of Canada, Ltd. Ford, Ont.

1913



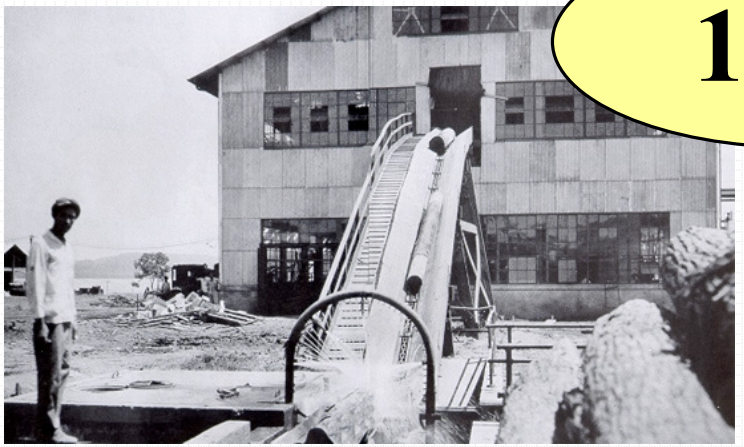


Sub-assembly Operations

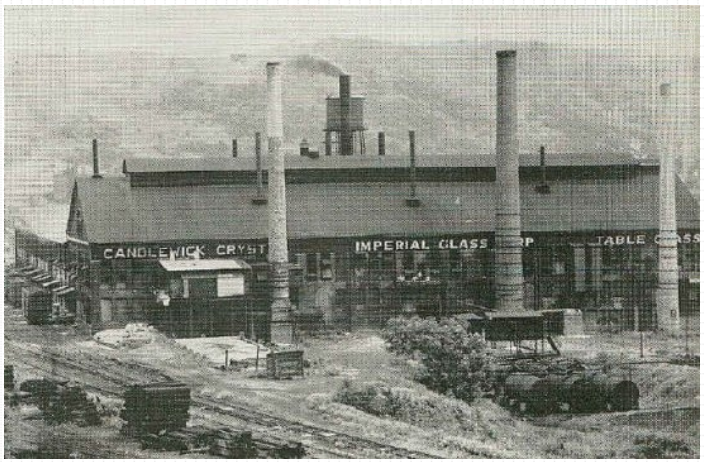
1913

1913

Steel



Wood



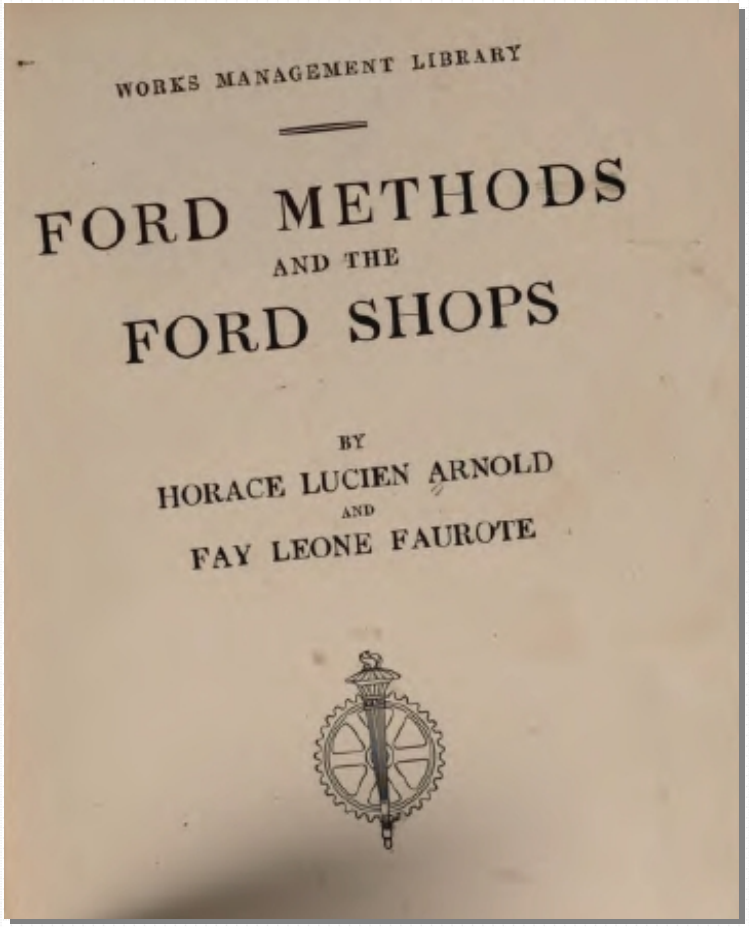
Glass

Leather

Rubber

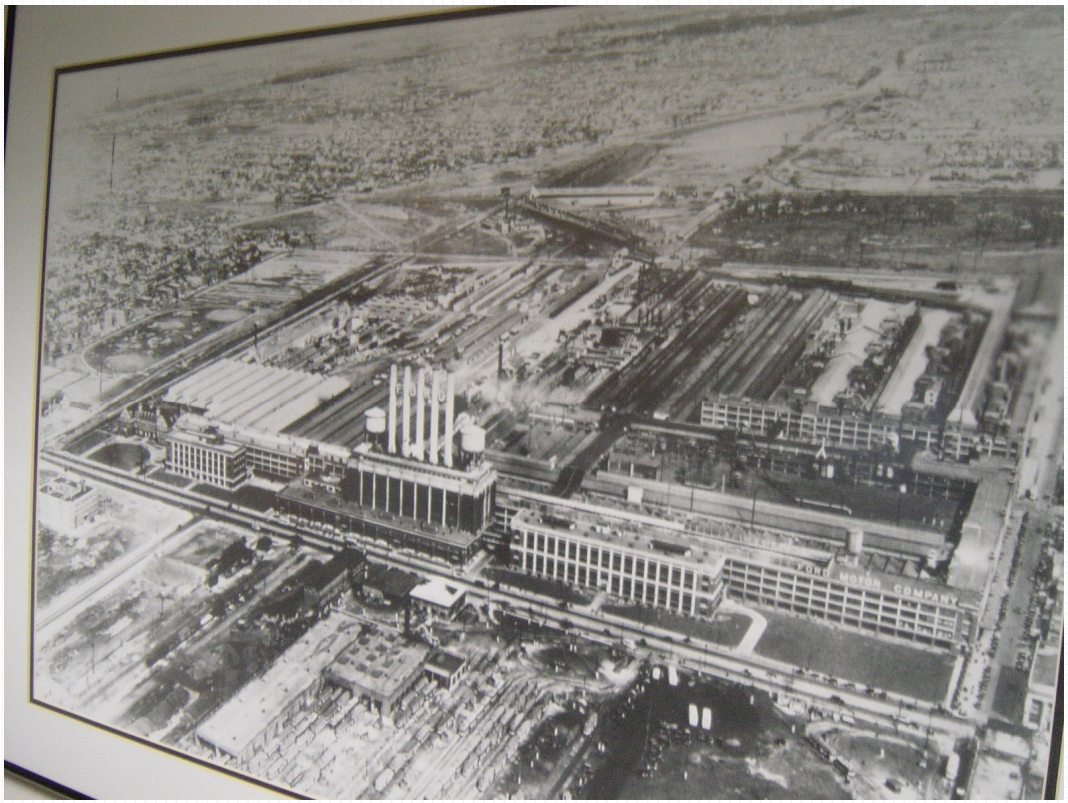
Roots of Lean: Ford Highland Park

1926


WORKS MANAGEMENT LIBRARY

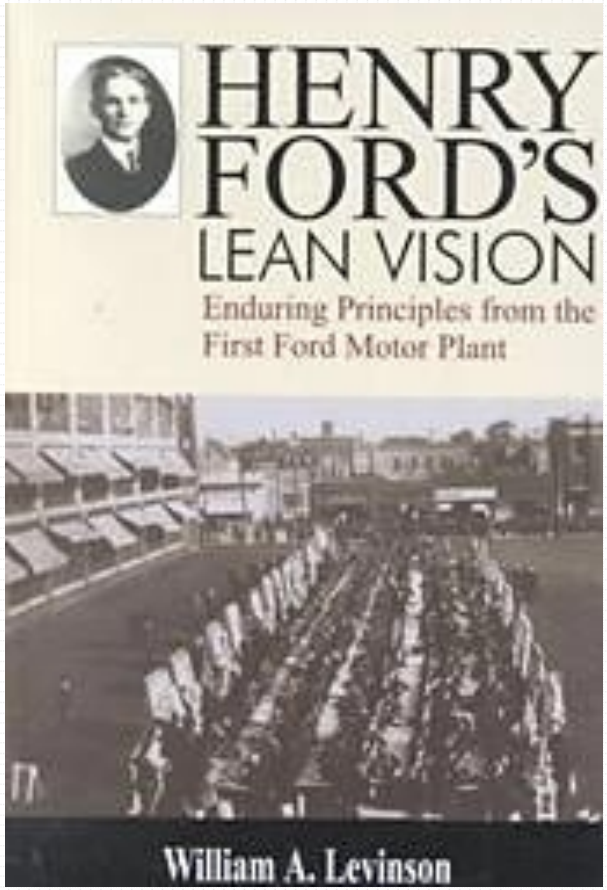
FORD METHODS
AND THE
FORD SHOPS

BY
HORACE LUCIEN ARNOLD
AND
FAY LEONE FAUROTE



Foundation of Lean Manufacturing

1926



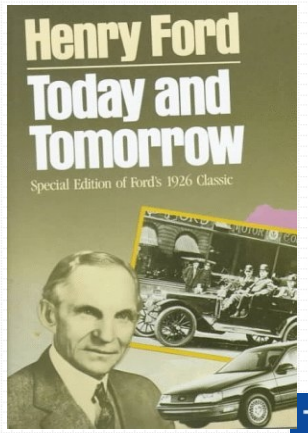
Why Standardize?

1926

To standardize a method is to choose out of many methods the best one, and use it....What is the best way to do a thing? It is the sum of all the good ways we have discovered up to the present. It, therefore, becomes the standard.

Today's standardization...is the necessary foundation on which tomorrow's improvement will be based. If you think of "standardization" as the best you know today, but which is to be improved tomorrow - you get somewhere. But if you think of standards as confining, then progress stops.

Henry Ford - Today and Tomorrow



Kiichiro Toyoda travels to Europe and the United States to investigate production of automobiles

1929

Production Toyoda Model AA Sedan, AB phaeton and GA truck announced

USA enters World War II

1941

Young men (factory operators) join the army and get shipped overseas …all the manufacturing knowledge goes with them

Women are recruited to join manufacturing

1941

and they do …

1941

TWI – Training within Industry

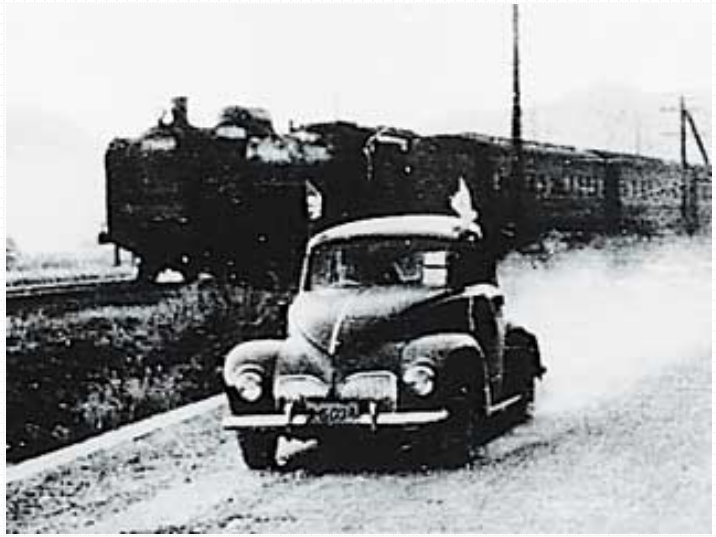
- The **Training within Industry** Program was established in August 1940 by the National Defense Advisory Commission and was continued under the Office of Production Management and then the War Production Board.
- By Presidential order on April 18, 1942, Training within Industry functions were made part of the War Manpower Commission.
- 22 TWI field District Training Centers were opened throughout the USA and 25 Policy Statement Bulletins issued
- By the end of World War II over 1.6 million workers in over 16,500 plants had received a certification.
- The Program concluded in April 1945

The Advisory Committee on Training

- United Aircraft Corporation
- United States Rubber Company
- Lockheed Aircraft Corporation
- Westinghouse Electric and Manufacturing Company
- The Falk Corporation
- Newport News Shipbuilding and Dry Dock Company
- International Association of Machinists
- Steel Workers Organizing Committee
- Industrial Union of Marine and Shipbuilding Workers of America
- International Brotherhood of Electrical Workers
- United Automobile Workers of America
- Operative Plasterers' and Cement Finishers' International Assn.

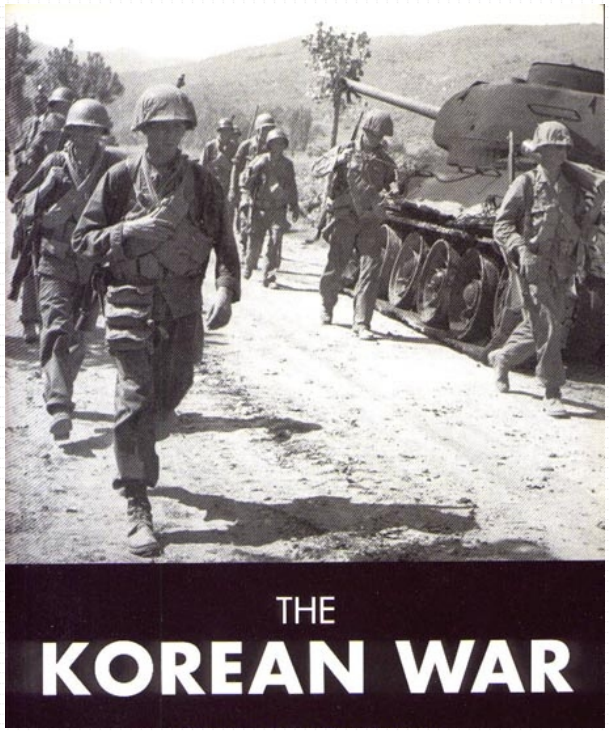
1950

- After WWII Japan experiencing a crisis in product quality. Japanese goods were thought to be cheap, easily broken and in general extremely poor quality.
- Toyota being on the edge of **bankruptcy** forces the company to re-visit how they conduct business
- **Financial crisis / Labor dispute** - Shoichiro Toyoda resigns as a President of Toyota. Eiji Toyoda becomes the new President.



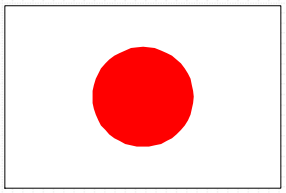
- Start of Korean war saves Toyota
- Taiichi Ohno is send to Detroit

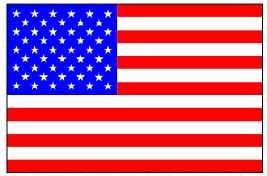
1951



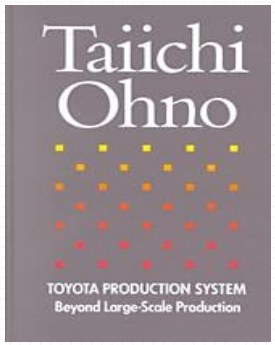
Toyota receives an order to build 5,000 trucks for US Army

Roots of Lean

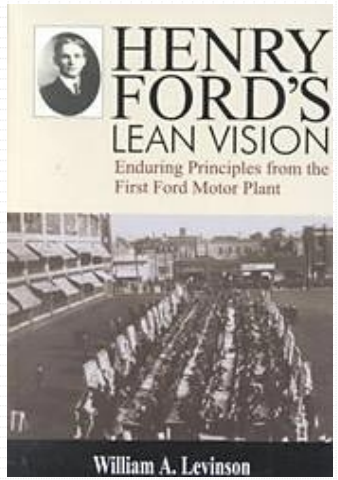




TPS
(Toyota Production System)
is born

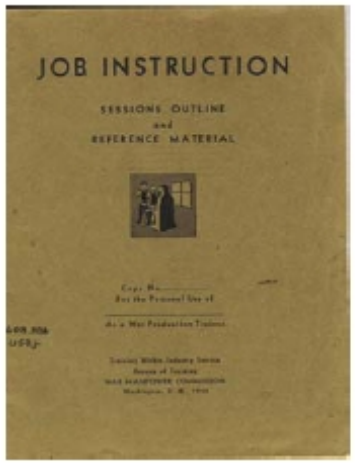


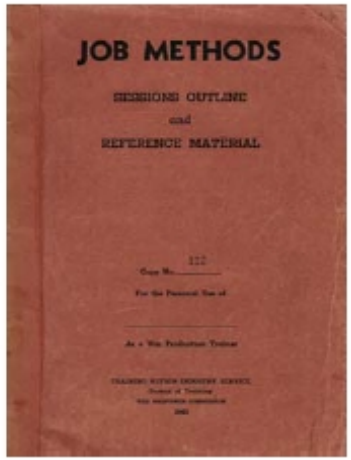

豊田重役アメリカ便り
デトロイトにて
「アメリカ便り:トヨタ新聞」(昭和25年)

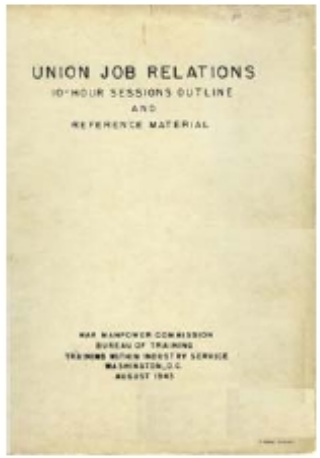


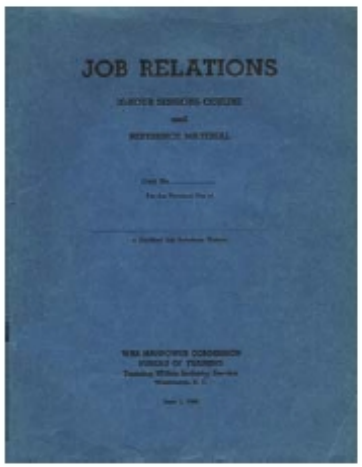
The Roots of Lean - TWI

Training Within Industry: The Origin of Japanese Management and Kaizen









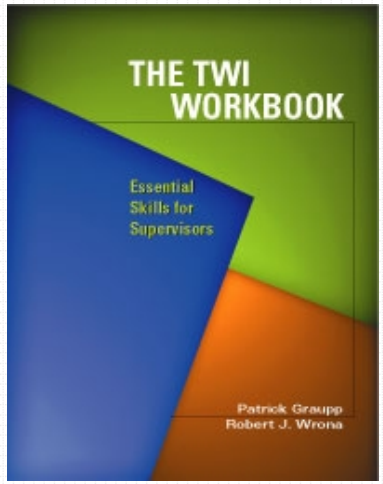
Training Within Industry (TWI)

TWI - **The training program instituted to support the U.S. war production effort from 1941 – 1945**

Millions of Americans
Trained over five year period.

This type of training is mostly forgotten in the US.

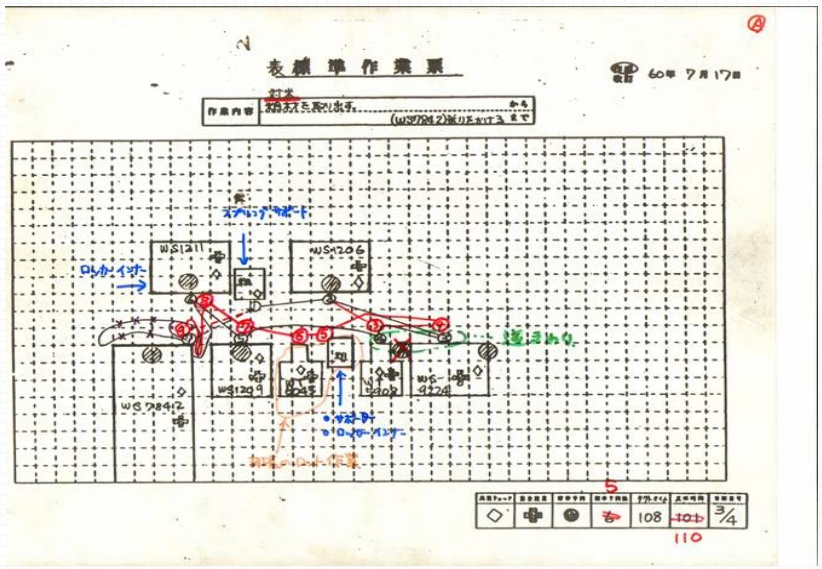
It formed the basis of Toyota's core training. Toyota still uses much of it to this day! [1].

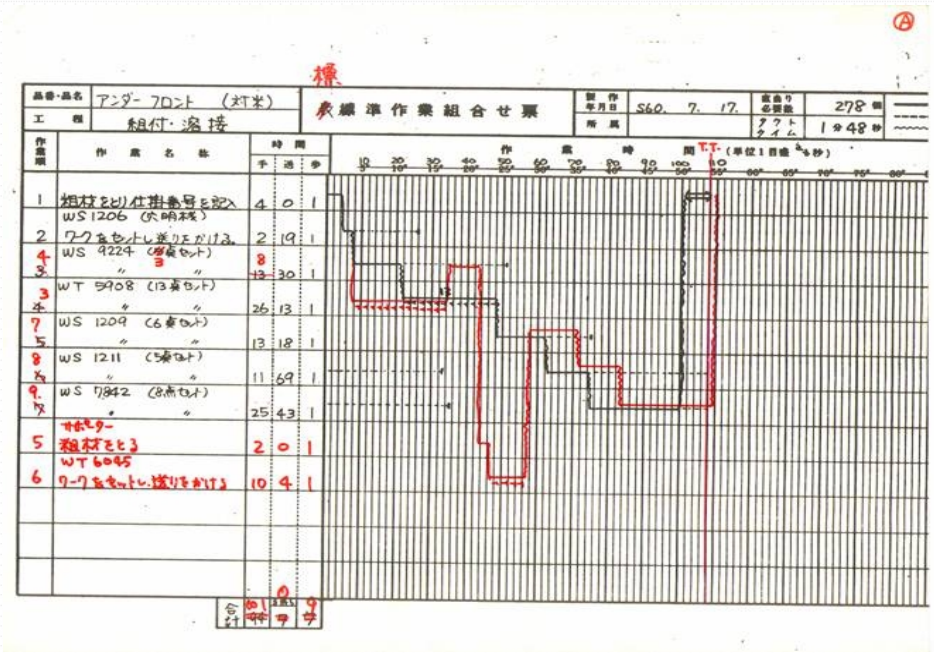


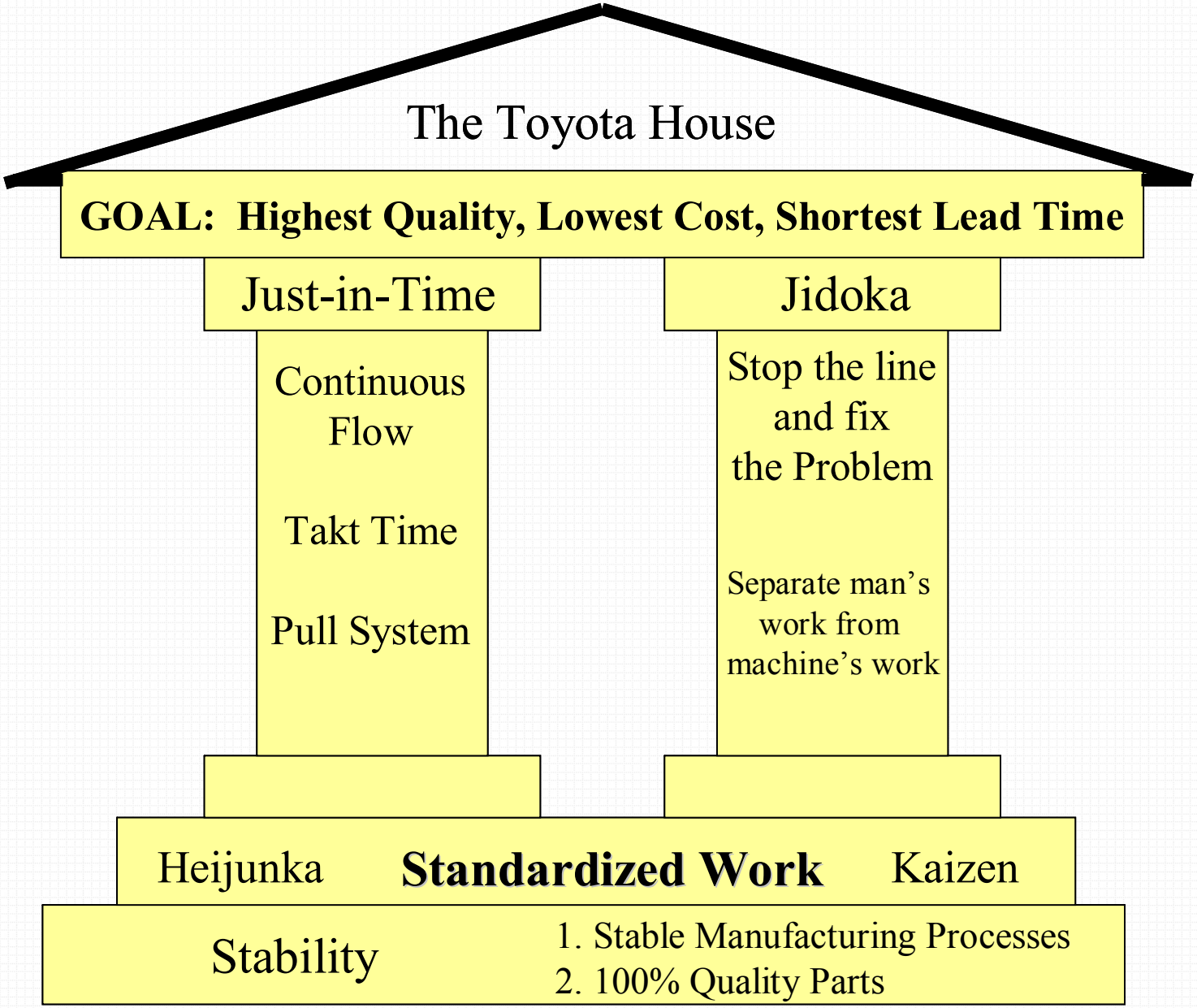
TWI Training for Supervisors

Toyota accepted teachings of TWI and incorporated them into TPS

Job Instruction	*the same*	***Job Instructions***
Job Methods	*became*	***Standardized Work / Kaizen***
Job Relations	*became*	***Supervisor Development***






The Toyota House
GOAL: Highest Quality, Lowest Cost, Shortest Lead Time
Just-in-Time
Jidoka
Continuous Flow
Takt Time
Pull System
Stop the line and fix the Problem
Separate man's work from machine's work
Heijunka
Standardized Work
Kaizen
Stability
1. Stable Manufacturing Processes
2. 100% Quality Parts

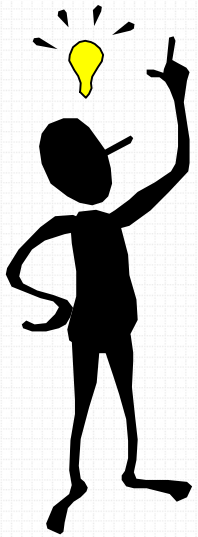
A lot has changed in almost 100 years

2010

But a lot stayed the same …

Standardized Work

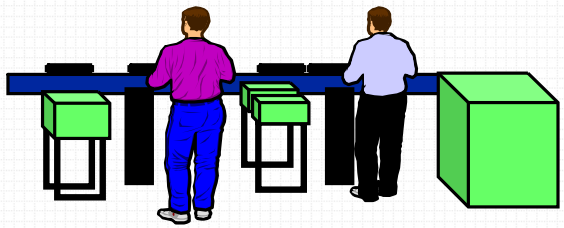
Advantages and Benefits



What is Standardized Work ?…

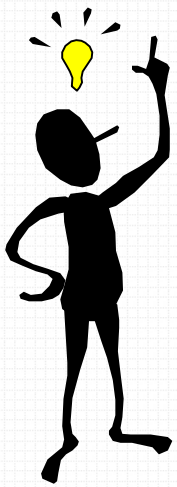
Standardized Work

- Standardized Work is **the best known method** for manufacturing products at a worksite.
- Standardized Work is a development of a starting point to measure the interaction between operator, machine, and materials to be used as a **problem solving tool**.
- Principles behind the Standardized Work:
  - to perform production efficiently
  - in a consecutive sequence
  - by focusing on operator movements and
  - by systematically combining work elements



Standardized Work Definition

Documents (forms)
centered around ***human motion*** that
combine the elements of a job into
the most effective sequence,
without waste,
to achieve the most efficient level of
production.



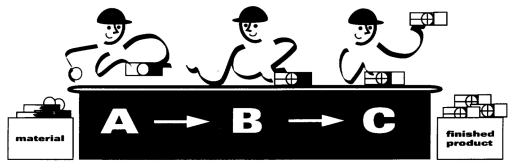
Benefits of Standardization

- Increases the level of safety
- Helps maintain and improve quality
- Stabilizes the work conditions
- Enables cost reduction
- Prevents overproduction
- Allow for easier judgment regarding “normal” versus “abnormal” situations
- Establishing a manufacturing system flexible to accommodate any future changes or improvements.
- Others …

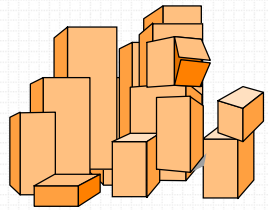
3 Elements of Standardized Work

1. **Takt Time**
   - time in which a single part is to be produced
   - meaning of the word "Takt" – Pacemaker

2. **Work Sequence**
   - a sequence of work in which operators transform raw materials into products



3. **Standard WIP - In-Process Stock**
   - a minimum quantity of parts that must always be on-hand for processing at a worksite



Three major Standardized Work Forms

#	Work Elements (Working or Walking - Waiting is NOT a work element)	Total Cycle Times #1	#2	#3	#4	#5	Type of Work*	Best Time**	Notes
	Process Capability Operator Time Observations	Line / Section		Date			Part Description		Created by:
1	*Load cross bar*	4.5	3.5	5.5	7.0	4.5	IW	4.5	*A lot of walking*
2	*Load C bracket*	6.5	4.5	5.5	5.5		IW	5.5	*A lot of walking*
3	*Insert pins and screws*	7.0	6.0	7.0	6.0		VA	6.0	*Using both hands*
4	*Start the machine*	1.0	1.0	1.0	1.0		IW	1.0	
x	*Waiting for machine to cycle*	7.0	7.0	7.0	7.0		W	7.0	*Waiting - 7 seconds*
5	*Unload C bracket*	4.5	10.0	4.5	4.5		IW	4.5	*Walk and inspect*
6	*Unload cross bar*	5.0	5.0	4.0	4.0		IW	4.0	*Walk and inspect*
	Total	25.5	30.0	27.5	28.0			**25.5**	

* Type of work includes one of the three: VA, IW or Waste
** Best time = lowest repeatable time that can be performed on regular basis (Standard operating time)

1. Process Capacity Sheet

STANDARDISED WORK COMBINATION TABLE

GROUP/TEAM : | Date: 16.03.2000
OPERATION # : | Process Name: Get up and dressed | Takt Time | Actual Takt Time: 840"

Sequence	WORK ELEMENT	ELEMENT TIME Hand Work	Mach-ine	Walk-ing
1	Get up	10		10
2	Clean the teeth	120		
3	Shave	120		20
4	Take a shower	120		20
5	Dry hair	60		20
6	Get dressed	150		20
7	Fill water tank & switch on	10	60	
8	Pour coffee	10		
9	Fill toaster and switch on	10	60	
10	Pour toast	10		30
11	Pick up keys	20		30
12	Put on shoes and coat	60		10
		700	120	160

Manual Work – – Automatic ∧∧∧∧ Walking ⟺ Waiting (Seconds) A.T.T. (Seconds)

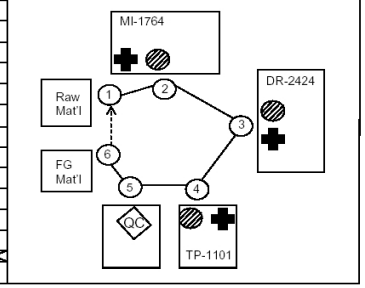
2. Standard Work Combination Table

Standardized Work Chart

Acme Corp.
Standardized Work Combination Table
Date: 5/23/2006 | By: Art of Lean | Approved By:
Plant: Acme | Product: Intake Manifold
Area: Machining | Op. _1_ of _1_
Process: Intake machining and pack | Pg. _1_ of _1_
Shifts: 2 | Takt Time: 30 secs. | Cycle Time: 30 secs.
Volume: 900 / shift

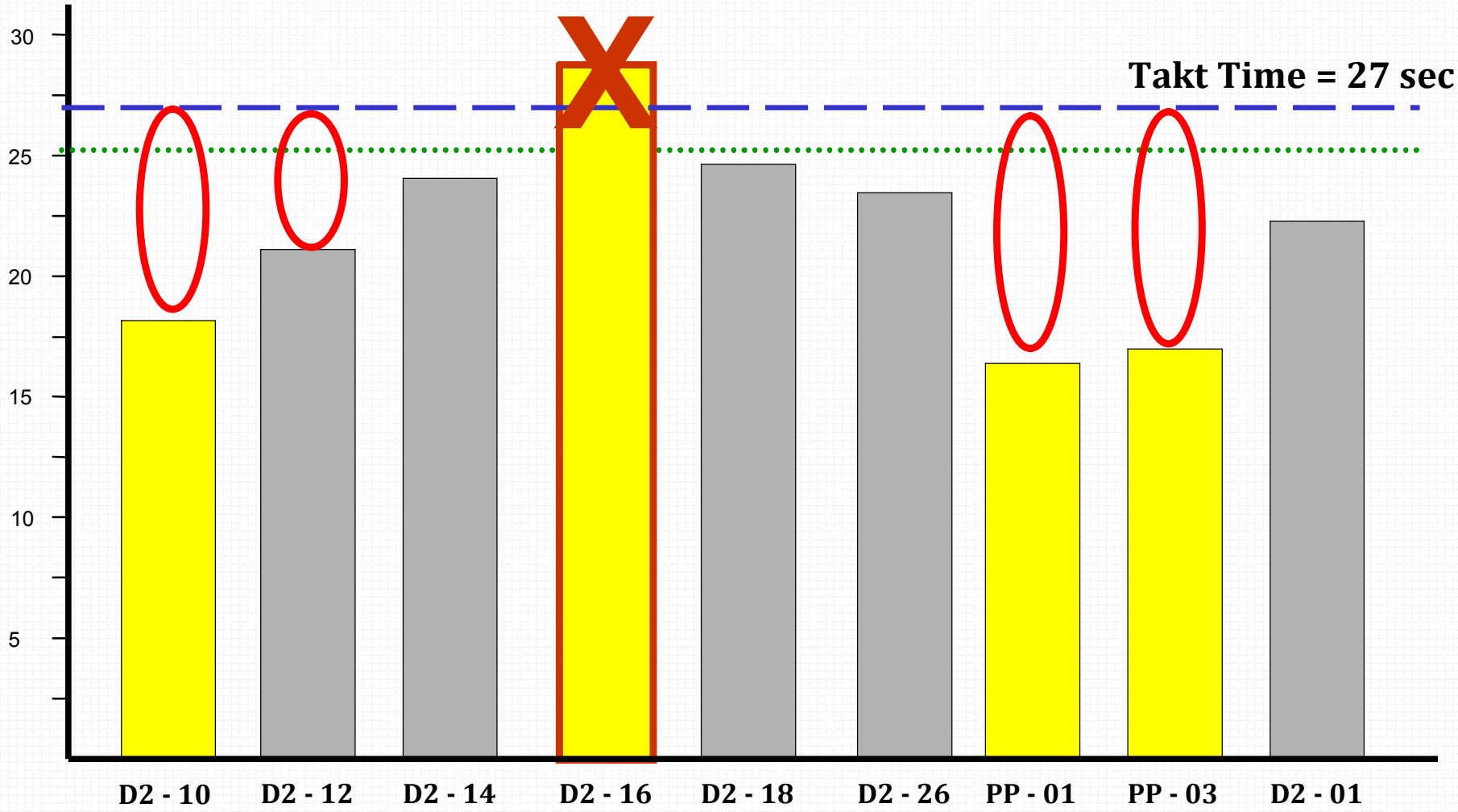
No.	Major Steps	MANE	AUTOMTE	WAITE	WALKE
1	Pick up raw material	2	--	--	2
2	Load part and start machine	3	25	--	2
3	Load part and start machine	3	21	--	2
4	Load part and start machine	3	11	--	2
5	Check threads	5	--	--	2
6	Pack part	2	--	--	2

Working Sequence
Walking
Return to Start
Safety | SWIP | Quality



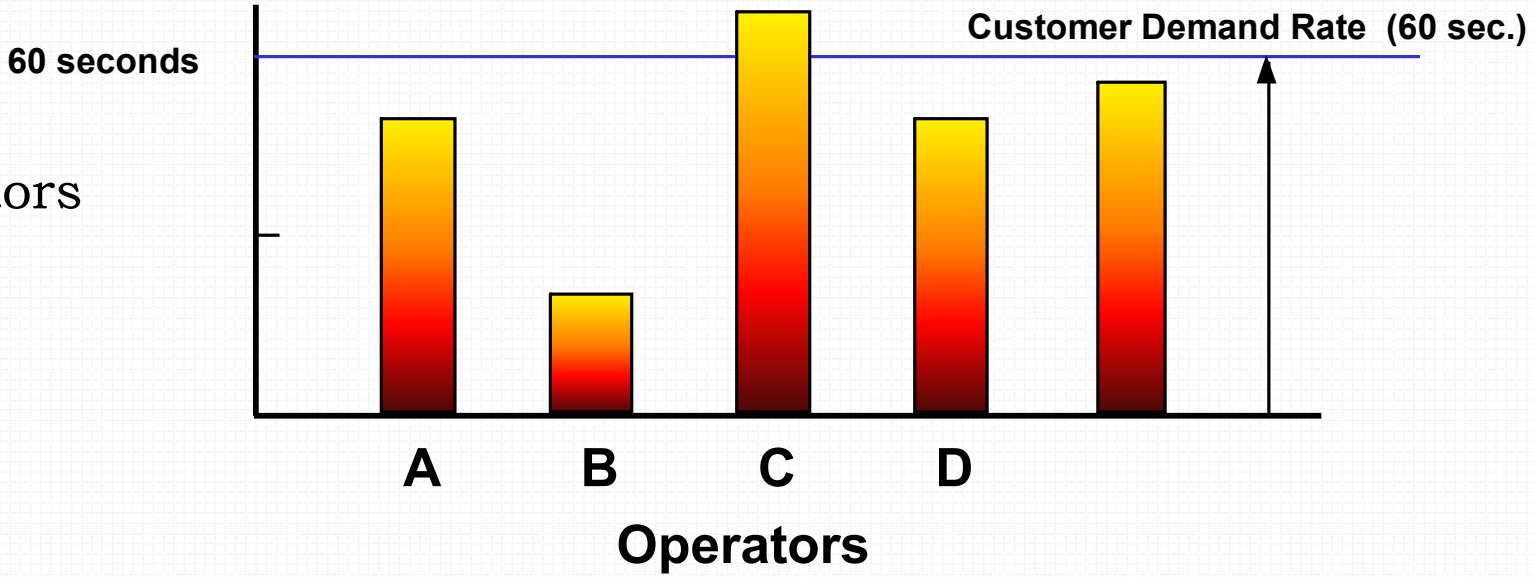
3. Standard Work Chart

Manpower Utilization

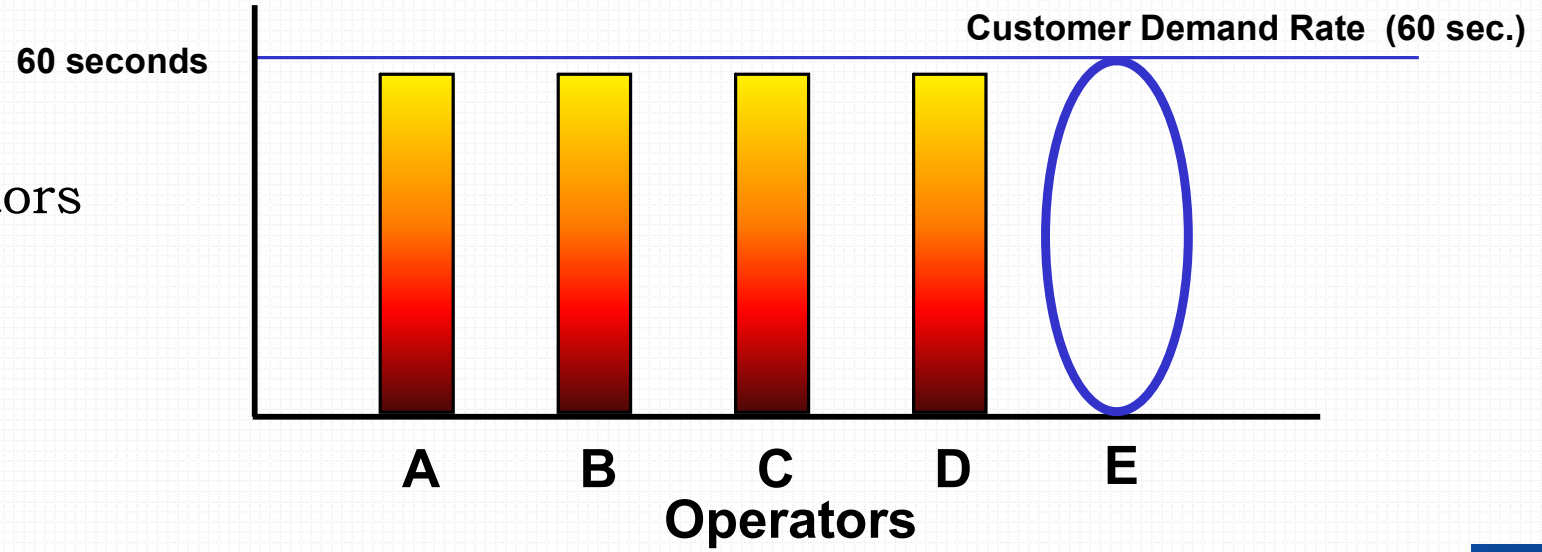


How many Operators do I need?

5 Operators



4 Operators

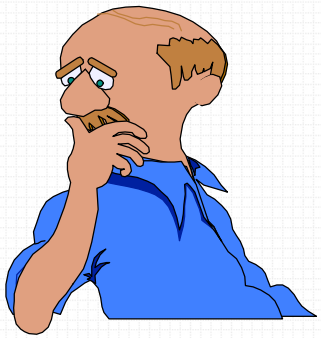


Line and Process Improvements

- With Standardized Work, the supervisor has a “base line” from which to he can identify problems more easily.
- If the movements of the operators are slightly different each time a process is performed, then the supervisor cannot clearly see problems or inefficiencies.
- Without standard work sequences, it is impossible to understand actual production efficiency, and impossible to measure the effect of any changes or improvements.
- Standardizing the work process is thus the first step toward improvement.

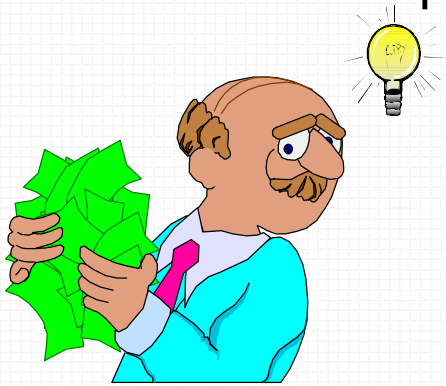
Without Standardization

Chaos situation



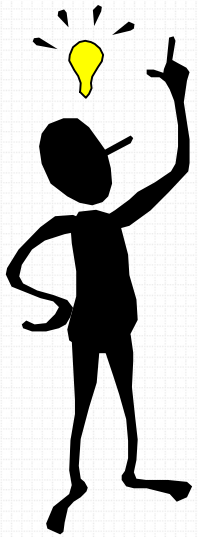
With Standardization

You can see where the problem is



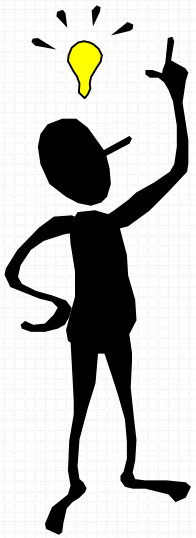
TWI – Training within Industry

Advantages and Benefits

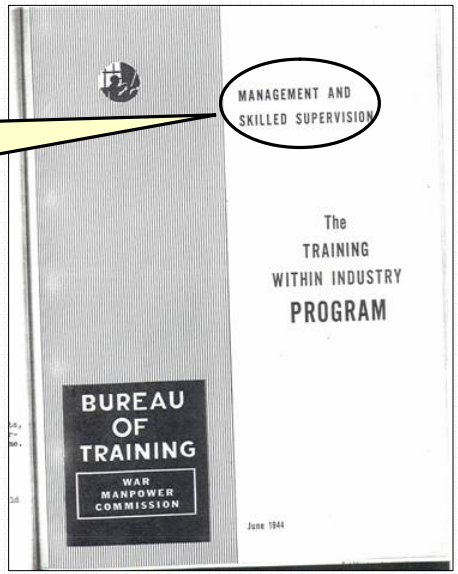


What is TWI ?…

The underlying purpose of TWI
is to assist industries
to meet their manpower needs
by training each worker to make the fullest
use of his best skills.

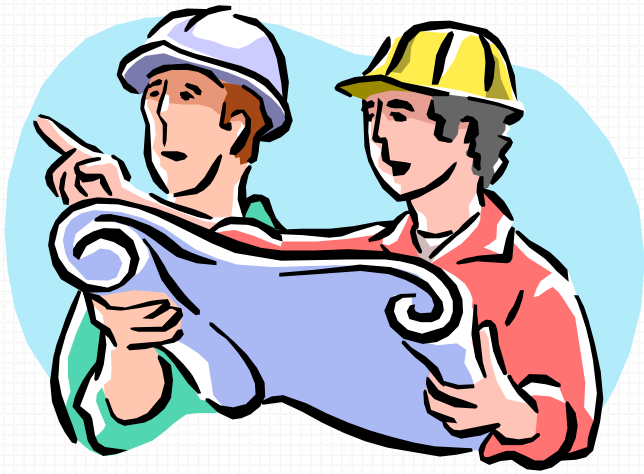


Management
and Skilled
Supervision



Leadership Skills in Production

1. **Knowledge of work** - how to perform a job
2. **Knowledge of responsibility** - what we need to do by when
3. **Skill in improvement** - how can we do this better
4. **Leadership** - behavior and motivation
5. **Teaching (Instructing) ability** - how to pass along our skills to others



TWI Training for Supervisors – **3 Js**

- ***Job Instruction*** gives the supervisor practice in how to train operators on new jobs.
- ***Job Methods*** helps the supervisor to simplify and improve methods of doing a job.
- ***Job Relations*** gives the supervisor practice in how to promote teamwork.

JI - Job Instructions Training

- How to train new and experienced workers
  - Identify your immediate training needs and develop a training timetable
  - Break down the job
  - Have the workplace properly arranged for training
- A four step approach to training:

  Step 1 - Prepare the worker

  Step 2 - Present the operation

  Step 3 - Try out period

  Step 4 - Follow-up period

Front of the Job Instruction Card

Back of the Job Instruction Card

JM - Job Methods Technique

STEP 1 – Break down the Job

List all details of the job exactly as done by the present method.

STEP 2 – Question every detail

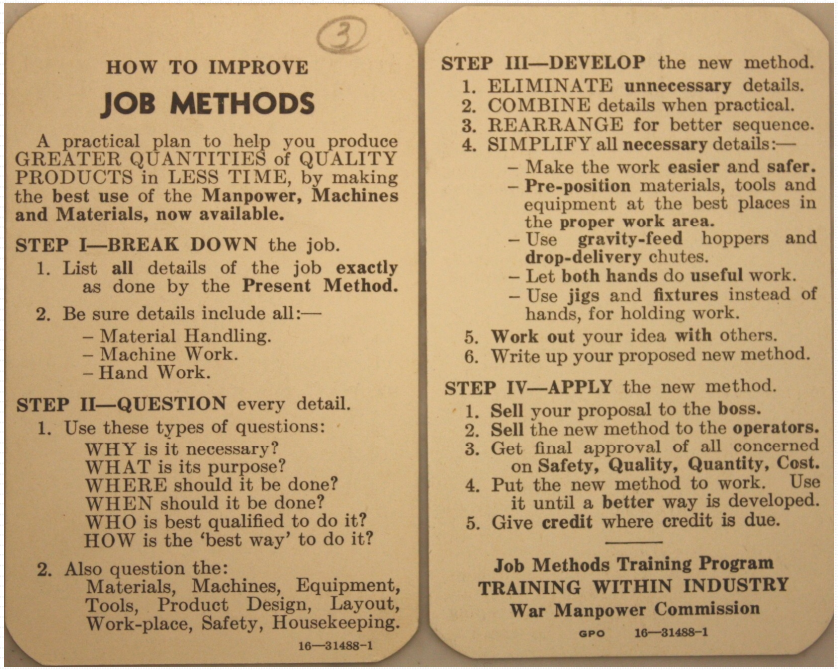
Why is this necessary? What is its purpose? Where should this be done?

STEP 3 – Develop the new method

Eliminate unnecessary details, combine details when practical, rearrange for better sequence, simplify work.

STEP 4 – Apply the new method

Get final approval of all concerned on safety, quality, quantity, cost. Put the new method to work.



HOW TO IMPROVE

JOB METHODS

A practical plan to help you produce GREATER QUANTITIES of QUALITY PRODUCTS in LESS TIME, by making the **best use** of the **Manpower, Machines and Materials, now available.**

STEP I—BREAK DOWN the job.

1. List **all** details of the job **exactly** as done by the **Present Method.**
2. Be sure details include all:—
   - Material Handling.
   - Machine Work.
   - Hand Work.

STEP II—QUESTION every detail.

1. Use these types of questions:
   WHY is it necessary?
   WHAT is its purpose?
   WHERE should it be done?
   WHEN should it be done?
   WHO is best qualified to do it?
   HOW is the 'best way' to do it?
2. Also question the:
   Materials, Machines, Equipment, Tools, Product Design, Layout, Work-place, Safety, Housekeeping.

16—31488-1

STEP III—DEVELOP the new method.

1. ELIMINATE **unnecessary** details.
2. COMBINE details when practical.
3. REARRANGE for better sequence.
4. SIMPLIFY all **necessary** details:—
   - Make the work **easier** and **safer.**
   - **Pre-position** materials, tools and equipment at the best places in the **proper work area.**
   - Use **gravity-feed** hoppers and **drop-delivery** chutes.
   - Let **both hands** do **useful** work.
   - Use **jigs** and **fixtures** instead of hands, for holding work.
5. **Work out** your idea **with** others.
6. Write up your proposed new method.

STEP IV—APPLY the new method.

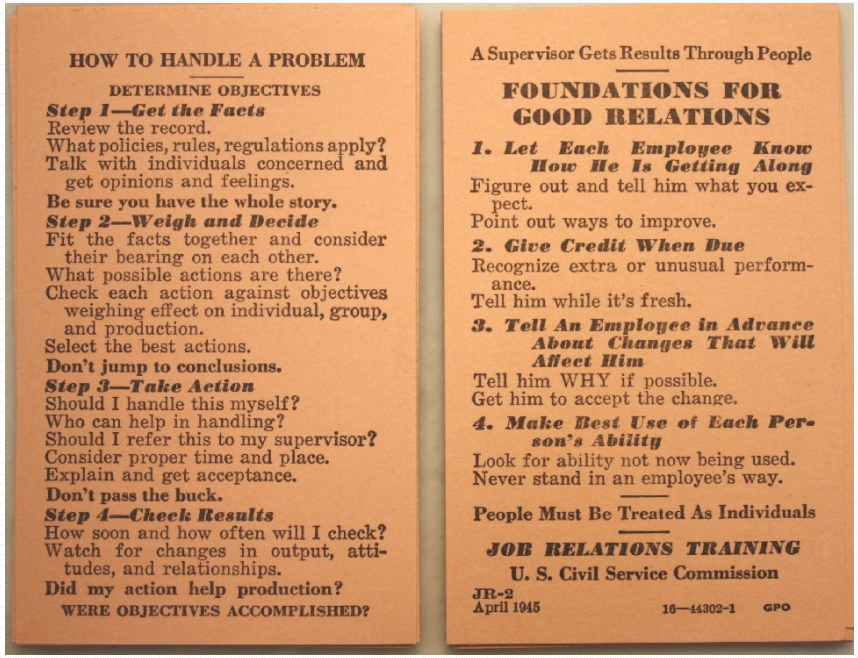
1. **Sell** your proposal to the **boss.**
2. **Sell** the new method to the **operators.**
3. Get final approval of all concerned on **Safety, Quality, Quantity, Cost.**
4. Put the new method to work. Use it until a **better** way is developed.
5. Give **credit** where credit is due.

Job Methods Training Program
TRAINING WITHIN INDUSTRY
War Manpower Commission

GPO 16—31488-1

JR - Job Relations Program

- The supervisor can avoid many problems in his department if he builds a foundation of good relations.
- TWI stresses these fundamentals:
  - Let each worker know how he is getting along
  - Give credit when due
  - Tell people in advance about changes that will affect them
- Problems do arise, the supervisor must be able to handle them before they seriously affect production or grow to larger proportions.



HOW TO HANDLE A PROBLEM

DETERMINE OBJECTIVES

Step 1—Get the Facts
Review the record.
What policies, rules, regulations apply?
Talk with individuals concerned and get opinions and feelings.
Be sure you have the whole story.

Step 2—Weigh and Decide
Fit the facts together and consider their bearing on each other.
What possible actions are there?
Check each action against objectives weighing effect on individual, group, and production.
Select the best actions.
Don't jump to conclusions.

Step 3—Take Action
Should I handle this myself?
Who can help in handling?
Should I refer this to my supervisor?
Consider proper time and place.
Explain and get acceptance.
Don't pass the buck.

Step 4—Check Results
How soon and how often will I check?
Watch for changes in output, attitudes, and relationships.
Did my action help production?

WERE OBJECTIVES ACCOMPLISHED?

A Supervisor Gets Results Through People

FOUNDATIONS FOR GOOD RELATIONS

1. Let Each Employee Know How He Is Getting Along
Figure out and tell him what you expect.
Point out ways to improve.

2. Give Credit When Due
Recognize extra or unusual performance.
Tell him while it's fresh.

3. Tell An Employee in Advance About Changes That Will Affect Him
Tell him WHY if possible.
Get him to accept the change.

4. Make Best Use of Each Person's Ability
Look for ability not now being used.
Never stand in an employee's way.

People Must Be Treated As Individuals

JOB RELATIONS TRAINING

U. S. Civil Service Commission

JR-2
April 1945 16—44302-1 GPO

TO MAKE YOUR WORK EASIER AND SAFER

USE THE THREE "J's"

HOW TO INSTRUCT

Step 1—Prepare the Worker
Put him at ease.
State the job and find out what he already knows about it.
Get him interested in learning job.
Place in correct position.

Step 2—Present the Operation
Tell, show, and illustrate one IMPORTANT STEP at a time.
Stress each KEY POINT.
Instruct clearly, completely, and patiently, but no more than he can master.

Step 3—Try Out Performance
Have him do the job—correct errors.
Have him explain each KEY POINT to you as he does the job again.
Make sure he understands.
Continue until YOU know HE knows.

Step 4—Follow Up
Put him on his own. Designate to whom he goes for help.
Check frequently. Encourage questions.
Taper off extra coaching and close follow-up.

If Worker Hasn't Learned, the Instructor Hasn't Taught

Know How

HOW TO GET READY TO INSTRUCT

Have a Time Table—
how much skill you expect him to have, by what date.

Break Down the Job—
list important steps.
pick out the key points. (Safety is always a key point.)

Have Everything Ready—
the right equipment, materials, and supplies.

Have the Workplace Properly Arranged—
just as the worker will be expected to keep it.

JOB INSTRUCTION TRAINING
Dept. of Safety & Personnel
THE PULLMAN COMPANY

KEEP THIS CARD HANDY

JOB INSTRUCTION

HOW TO IMPROVE JOB METHODS

A practical plan to help you produce GREATER QUANTITIES of QUALITY PRODUCTS in LESS TIME, by making the best use of the Manpower, Machines and Materials, now available.

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2. Be sure details include all:
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   —Hand Work.

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   WHERE should it be done?
   WHEN should it be done?
   WHO is best qualified to do it?
   HOW is the "best way" to do it?
2. Also question the:
   Materials, Machines, Equipment, Tools, Product Design, Layout, Workplace, Safety, Housekeeping.

BETTER WAY

Step III—DEVELOP the new method
1. ELIMINATE unnecessary details.
2. COMBINE details when practical.
3. REARRANGE for better sequence.
4. SIMPLIFY all necessary details.

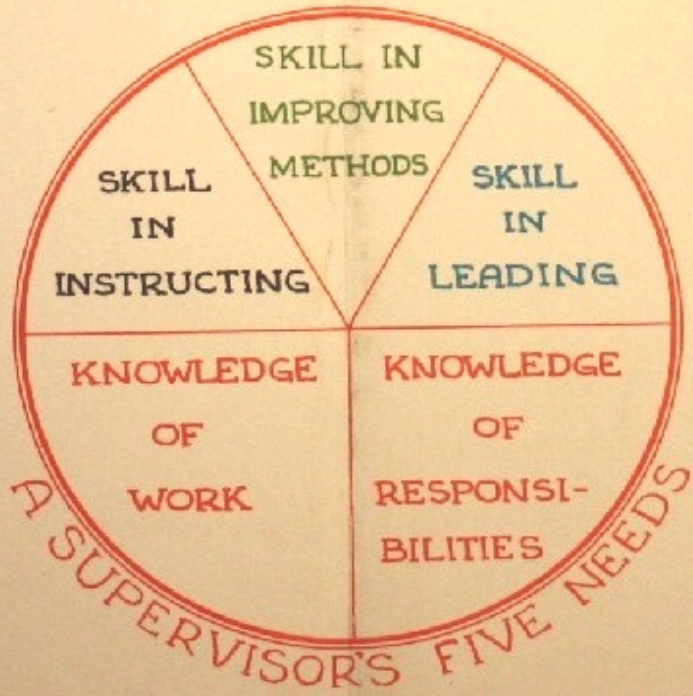
To make the work easier and safer:
   —Pre-position materials, tools and equipment at the best places in the proper work area.
   —Use gravity-feed hoppers and drop-delivery chutes.
   —Let both hands do useful work.
   —Use jigs and fixtures instead of hands for holding work.

5. Work out your idea with others.
6. Write up your proposed new method.

Step IV—APPLY the new method
1. Sell your proposal to your "boss."
2. Sell the new method to the operators.
3. Get final approval of all concerned on Safety, Quality, Quantity, Cost.
4. Put the new method to work. Use it until a better way is developed.
5. Give credit where credit is due.

JOB METHODS PROGRAM
Dept. of Safety & Personnel
THE PULLMAN COMPANY

JOB METHODS



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DETERMINE OBJECTIVES

1—GET THE FACTS
Review the record.
Find out what rules and plant customs apply.
Talk with individuals concerned.
Get opinions and feelings.
Be sure you have the whole story.

2—WEIGH AND DECIDE
Fit the facts together.
Consider their bearing on each other.
What possible actions are there?
Check practices and policies.
Consider objective and effect on individual, group, and production.
Don't jump at conclusions.

3—TAKE ACTION
Are you going to handle this yourself?
Do you need help in handling?
Should you refer this to your supervisor?
Watch the timing of your action.
Don't pass the buck.

4—CHECK RESULTS
How soon will you follow up?
How often will you need to check?
Watch for changes in output, attitudes, and relationships.
Did your action help production?

Confidence To Proceed

JOB RELATIONS

A SUPERVISOR GETS RESULTS THROUGH PEOPLE

Foundations for Good Relations

Let each worker know how he is getting along.
Figure out what you expect of him.
Point out ways to improve.
Give credit when due.
Look for extra or unusual performance.
Tell him while "it's hot."
Tell people in advance about changes that will affect them.
Tell them WHY if possible.
Get them to accept the change.
Make best use of each person's ability.
Look for ability not now being used.
Never stand in a man's way.

People Must Be Treated as Individuals

JOB RELATIONS TRAINING
Dept. of Safety & Personnel
THE PULLMAN COMPANY

JOB RELATIONS

BETTER SERVICE THROUGH SKILLED SUPERVISION

THE PULLMAN COMPANY
DEPT. OF SAFETY AND PERSONNEL

Submitted by—S. F. Eastin,
Supervisor of Training,
Shreveport, Louisiana

Job Breakdown sheet

Job Breakdown Sheet

Work Center : _____ Ref no.: _____

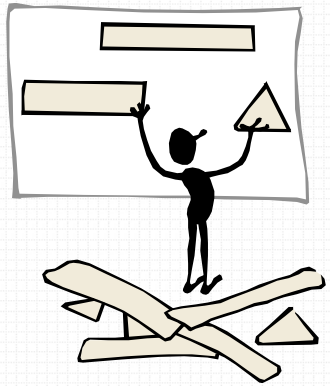
Equipment / Operation: _____

Parts (P/N): _____ Date: _____

Tools & Material: _____ By: _____

Safety Equipment: _____

MAJOR STEPS	KEY POINTS	REASONS
1		
2		
3		
4		
5		
6		
7		
8		



Handout

Sequence of Work Elements – Major Steps

- Major steps are work elements used to describe the steps (sequence) to perform a job, operate a machine, assemble a part or change a tool, etc …
- Major steps work elements are those which are required to complete a job at a very basic level
- By combining major steps work elements in a sequence we are able to complete a whole job
- Any job can be broken into a series of elements. When analyzing the contents of an operation it is very important to understand what makes up the most basic elements of a job

Operator observations

- Observe an operation until you fully understand all operator's movements, motions and sequence
- Breakdown each operation into Major Steps Work Elements.
- Identify a **Starting point** and a **Finishing point** for each work element
- Major Step is the smallest amount of work that can be performed by one person.
- Set several work elements into groups substantial enough to time them in seconds
- Establish the lowest repeatable time per each work element.

Job Breakdown Sheet

Work Center :	Cotton T-shirt production line	Ref no.:	LT 007
Operation:	Folding T-shirt for packaging. Station TF17	Date:	April 25,2021
Parts (P/N):	T-2504	By:	Andreas MacPhail
Tools & Material:	Not required	Pre-Requisites:	None
Safety Equipment:	Not necessary		

	MAJOR STEPS	KEY POINTS	REASONS
1	Lay down T-shirt flat in front of you	•Front side up and sideways •Neck opening to your right	Starting point of the process
2	With your left hand find a center point and pinch it	•Center point of the T-shirt from left to right •Pinch it about 2 inched form the far edge	This way the shirt is evenly distributed inside the package
3	With your right hand grasp the top edge of the shirt	•With your right hand draw an imaginary line from your left hand to the right edge of the shirt •Parallel to the edge of the shirt. •Grasp it half way between the neck and the sleeve	So the neck opening of the shirt is displayed in the center of the package
4	Cross your right hand over your left	•Towards the waist-opening end of the T-shirt •Hold on to the T-shirt •Maintain the same imaginary line	This is a starting point of the folding process.
5	Add a new grasp to your right hand	•About 2 inched form the far edge	In the next step you will be lifting a shirt up
6	Uncross your hands and lift the T-shirt	•Extend your hands in front of you •Hold on to the T-shirt and shake it few times •Lift the T-shirt up perpendicular to the floor	You are shaking it to remove any wrinkles from the shirt.
7	Lower and fold the T-shirt	•Lower the loose arm to the table •Wave the shirt away from you •Fold it in a circular motion towards you	This is a final step of the process before the T-shirt is inserted into a package. You want it to be presentable.

Example of Job Breakdown Sheet – Operating room

Major Steps	Keypoints	Reasons for Key points
Prep the patient	1. Set out central line kit 2. Check lab reports 3. Lay patient on back 4. Place rolled up towel between patient's shoulderblades	1. immediate access to materials 2. prevents potential adverse affects of the procedure/check to see if procedure could be potentially harmful to the patient 3. makes access to vena cava easier 4. makes finding the clavicle easier
Apply anesthetic	1. Swab chest with antiseptic 2. Inject 5cc's of lidocaine	1. prevents infection 2. keeps the patient from feeling excessive pain
Insert needle into vena cava	1. Find clavicle 2. Puncture chest with right under the clavicle 3. Continue to push needle into the subclavian vein with a steep angle 4. Pull back on the syringe 5. Pull syringe off, leaving the needle in place	1. makes locating the vena cava easier 2. finds subclavian vein 3. avoid puncturing the lungs 4. indicates if the needle is in the vena cava or an artery. Maroon blood indicates vena cava, red blood, artery. 5. helps to put the guidewire in place
Insert guidewire	1. Insert guidewire into the needle's bore and into the vena cava 2. Do not force in 3. Do not let go 4. Do not let wire touch anything unsterile	1. serves as a placeholder for the dilator and the central line 2. prevents damaging the vena cava or the heart 3. prevents loss of the wire inside the patient 4. prevents infection
Dilate the puncture point	1. Remove needle and replace it with a thick plastic	1. the plastic widens the vein opening
Put in the central line	1. Remove plastic, thread the line over the wire until it is all the way into the vena cava 2. Remove wire 3. Flush the line with heparin solution with a syringe 4. Suture the central line into the chest	1. inserts the central line into the vena cava 2. wire is no longer needed 3. removes fluids out of the central line 4. keeps the line in place

‘Standard Operation’

STANDARD OPERATION SHEET

OPERATION NAME

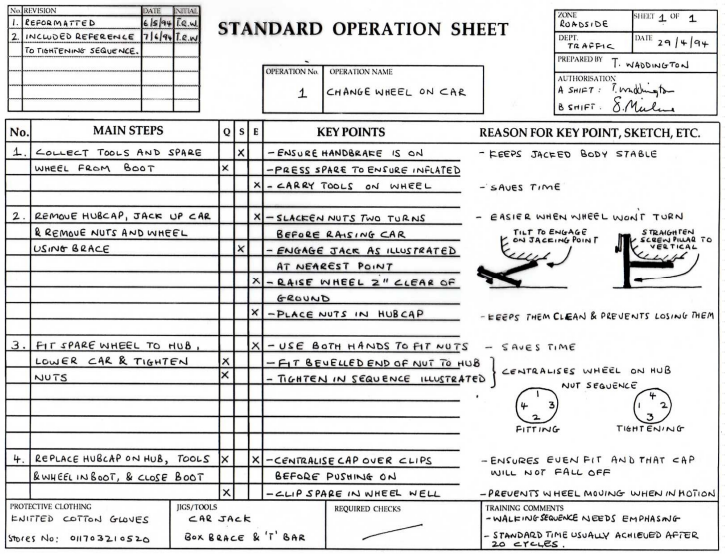
Hydromation plant start up

MAIN STEPS	KEY POINTS	REASON FOR KEY POINT, SKETCH, ETC.
Open dirty water return v/vs until	Ensure valves fully open	Giving optimum pump performance
handle stops turning		
Check slurry water level	Float must make circuit	System will not start up
Turn power ‘on’, isolator		
Start up filter pump by depressing button	Filter pump light turns green	
Start filter process by depressing button		
Wait for blowdown	Water surge must be seen and heard in tank	Slurry pump will now run
Wait for 4 minutes for precoating of tubes		
Check filter powder level	Not less than 6” from top of container	So that powder doesn’t run out
Check for normal operation	All lights on panel are green	

Major Steps - Work Elements

Training within Industry

Teaching the job



STANDARD OPERATION SHEET

No.	REVISION	DATE	INITIAL
1.	REFORMATTED	6/5/94	T.C.W.
2.	INCLUDED REFERENCE TO TIGHTENING SEQUENCE.	7/6/94	T.C.W.

ZONE ROADSIDE | SHEET 1 OF 1
DEPT. TRAFFIC | DATE 29/4/94
PREPARED BY T. WADDINGTON
AUTHORISATION A SHIFT: T. Waddington B SHIFT: S. Mullen

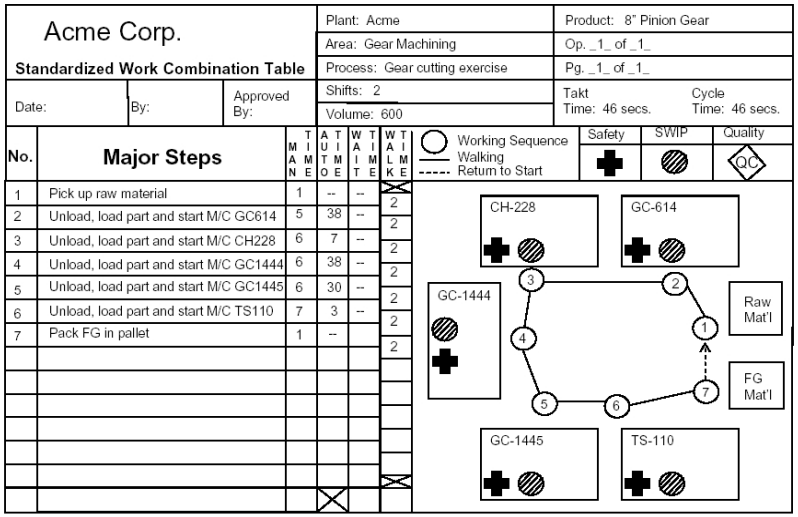
OPERATION No. 1 | OPERATION NAME: CHANGE WHEEL ON CAR

No.	MAIN STEPS	Q	S	E	KEY POINTS	REASON FOR KEY POINT, SKETCH, ETC.
1.	COLLECT TOOLS AND SPARE			X	- ENSURE HANDBRAKE IS ON	- KEEPS JACKED BODY STABLE
	WHEEL FROM BOOT	X			- PRESS SPARE TO ENSURE INFLATED	
				X	- CARRY TOOLS ON WHEEL	- SAVES TIME
2.	REMOVE HUBCAP, JACK UP CAR			X	- SLACKEN NUTS TWO TURNS BEFORE RAISING CAR	- EASIER WHEN WHEEL WON'T TURN
	& REMOVE NUTS AND WHEEL					
	USING BRACE			X	- ENGAGE JACK AS ILLUSTRATED AT NEAREST POINT	TILT TO ENGAGE ON JACKING POINT / STRAIGHTEN SCREW PILLAR TO VERTICAL
				X	- RAISE WHEEL 2" CLEAR OF GROUND	
				X	- PLACE NUTS IN HUBCAP	- KEEPS THEM CLEAN & PREVENTS LOSING THEM
3.	FIT SPARE WHEEL TO HUB,			X	- USE BOTH HANDS TO FIT NUTS	- SAVES TIME
	LOWER CAR & TIGHTEN	X			- FIT BEVELLED END OF NUT TO HUB	- CENTRALISES WHEEL ON HUB NUT SEQUENCE
	NUTS	X			- TIGHTEN IN SEQUENCE ILLUSTRATED	FITTING / TIGHTENING
4.	REPLACE HUBCAP ON HUB, TOOLS	X		X	- CENTRALISE CAP OVER CLIPS	- ENSURES EVEN FIT AND THAT CAP WILL NOT FALL OFF
	& WHEEL IN BOOT, & CLOSE BOOT				BEFORE PUSHING ON	
		X			- CLIP SPARE IN WHEEL WELL	- PREVENTS WHEEL MOVING WHEN IN MOTION

PROTECTIVE CLOTHING: KNITTED COTTON GLOVES — STORES No: 0117032105 20
JIGS/TOOLS: CAR JACK; BOX BRACE & 'T' BAR
REQUIRED CHECKS
TRAINING COMMENTS: - WALKING SEQUENCE NEEDS EMPHASING - STANDARD TIME USUALLY ACHIEVED AFTER 20 CYCLES.

Standardized Work

Analyzing the job



Acme Corp.
Standardized Work Combination Table
Date: | By: | Approved By:

Plant: Acme | Product: 8" Pinion Gear
Area: Gear Machining | Op. _1_ of _1_
Process: Gear cutting exercise | Pg. _1_ of _1_
Shifts: 2 | Takt Time: 46 secs. | Cycle Time: 46 secs.
Volume: 600

No.	Major Steps	MAN TIME	AUTO TIME	WAIT TIME	WALK TIME
1	Pick up raw material	1	--	--	2
2	Unload, load part and start M/C GC614	5	38	--	2
3	Unload, load part and start M/C CH228	6	7	--	2
4	Unload, load part and start M/C GC1444	6	38	--	2
5	Unload, load part and start M/C GC1445	6	30	--	2
6	Unload, load part and start M/C TS110	7	3	--	2
7	Pack FG in pallet	1	--		2

Working Sequence / Walking / Return to Start
Safety | SWIP | Quality (QC)

CH-228, GC-614, GC-1444, GC-1445, TS-110, Raw Mat'l, FG Mat'l

How to change a tire

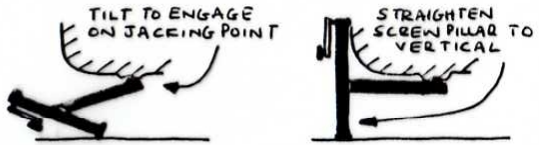
No.	REVISION	DATE	INITIAL
1.	REFORMATTED	6/5/94	T.R.W.
2.	INCLUDED REFERENCE TO TIGHTENING SEQUENCE.	7/6/94	T.R.W

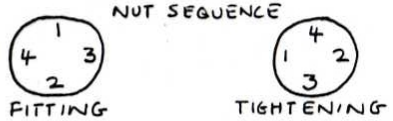
STANDARD OPERATION SHEET

OPERATION No.	OPERATION NAME
1	CHANGE WHEEL ON CAR

ZONE ROADSIDE	SHEET 1 OF 1
DEPT. TRAFFIC	DATE 29/4/94
PREPARED BY T. WADDINGTON	
AUTHORISATION A SHIFT: T. Waddington	
B SHIFT: S. Mulcahy	

No.	MAIN STEPS	Q	S	E	KEY POINTS	REASON FOR KEY POINT, SKETCH, ETC.
1.	COLLECT TOOLS AND SPARE		X		- ENSURE HANDBRAKE IS ON	- KEEPS JACKED BODY STABLE
	WHEEL FROM BOOT	X			- PRESS SPARE TO ENSURE INFLATED	
				X	- CARRY TOOLS ON WHEEL	- SAVES TIME
2.	REMOVE HUBCAP, JACK UP CAR			X	- SLACKEN NUTS TWO TURNS	- EASIER WHEN WHEEL WON'T TURN
	& REMOVE NUTS AND WHEEL				BEFORE RAISING CAR	
	USING BRACE		X		- ENGAGE JACK AS ILLUSTRATED	
					AT NEAREST POINT	
				X	- RAISE WHEEL 2" CLEAR OF	
					GROUND	
				X	- PLACE NUTS IN HUBCAP	- KEEPS THEM CLEAN & PREVENTS LOSING THEM
3.	FIT SPARE WHEEL TO HUB,			X	- USE BOTH HANDS TO FIT NUTS	- SAVES TIME
	LOWER CAR & TIGHTEN	X			- FIT BEVELLED END OF NUT TO HUB	CENTRALISES WHEEL ON HUB
	NUTS	X			- TIGHTEN IN SEQUENCE ILLUSTRATED	
4.	REPLACE HUBCAP ON HUB, TOOLS	X		X	- CENTRALISE CAP OVER CLIPS	- ENSURES EVEN FIT AND THAT CAP WILL NOT FALL OFF
	& WHEEL IN BOOT, & CLOSE BOOT				BEFORE PUSHING ON	
		X			- CLIP SPARE IN WHEEL WELL	- PREVENTS WHEEL MOVING WHEN IN MOTION





PROTECTIVE CLOTHING	JIGS/TOOLS	REQUIRED CHECKS	TRAINING COMMENTS
KNITTED COTTON GLOVES Stores No: 01170321052O	CAR JACK BOX BRACE & 'T' BAR		- WALKING SEQUENCE NEEDS EMPHASING - STANDARD TIME USUALLY ACHIEVED AFTER 20 CYCLES.

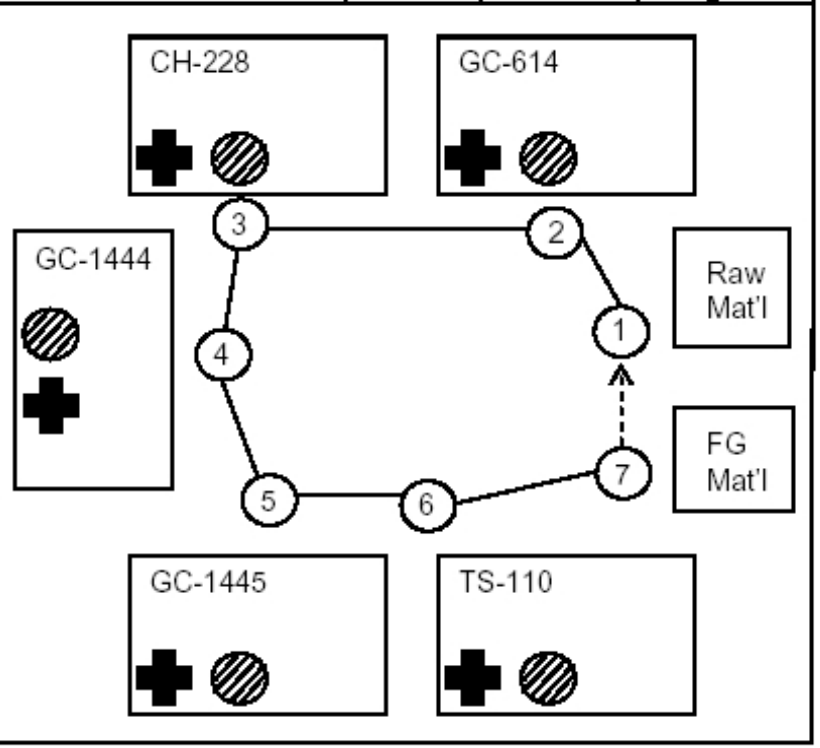
Standardized Work Chart

Acme Corp.	Plant: Acme	Product: 8" Pinion Gear
Standardized Work Combination Table	Area: Gear Machining	Op. _1_ of _1_
	Process: Gear cutting exercise	Pg. _1_ of _1_
Date: / By: / Approved By:	Shifts: 2	Takt Time: 46 secs. / Cycle Time: 46 secs.
	Volume: 600	

No.	Major Steps	MAN TIME	AUTO TIME	WAIT TIME	WALK TIME
1	Pick up raw material	1	--	--	2
2	Unload, load part and start M/C GC614	5	38	--	2
3	Unload, load part and start M/C CH228	6	7	--	2
4	Unload, load part and start M/C GC1444	6	38	--	2
5	Unload, load part and start M/C GC1445	6	30	--	2
6	Unload, load part and start M/C TS110	7	3	--	2
7	Pack FG in pallet	1	--		2
			X		

Working Sequence
Walking
Return to Start

Safety | SWIP | Quality (QC)



The End

Introduction to
Standardized Work and TWI

Lean Transformation Solutions

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