STANDARDIZED WORK

3RD SESSION

STANDARDIZED WORK AND WORK STANDARDS - SESSION 3

AIM	(1) The Basic Concepts of Standardized Work, Practice, and Understanding (2) Role of Process Capacity Sheet and Practice Filling Out (3) Basic Time Measurement Practice

TITLES AND CONTENTS

No.	Title	Main Contents	Time	TP
I	Open the Training Session	(1) Review Main Points of Session 2 (2) Explain Session 3 Outline Schedule		
II	Standardized Work	(1) JIT and In Station Process Control (2) Conditions for Standardized Work (3) Establishing Standardized Work (4) Standardized Work and TPS		
III	Creation of Standardized Work	(1) Process Capacity Sheet (2) Practice Creating Process Capacity Sheet		
IV	Time Measurement	(1) Time & Motion (2) Time Measurement Instruction (3) Observation Practice (4) Plant Floor Observation Methods		
V	Closing the Session	(1) Summary of Session 3 (2) Preparation for next session		

Things to Prepare

1	Participant Manual and Transparencies
2	Stop Watch
3	Work Standard, Standardized Work Forms
4	Blank Process Capacity Sheets Practice Exercise
5	Blank Time Observation Forms
6	Time Observation Practice Material

Items to Distribute

1	Standardized Work Forms
2	Work Standard Forms
3	Movement Analysis Form
4	Time Measurement Form
5	Stop Watch

Standardized Work and Work Standards - Session 3

Slide List

INDEX
TPS Standardized Work and Work Standards
Session 3

I. Opening The Training Session

Opening Remarks & Greetings

- Welcome the participants to session 3 of TPS Standardized Work Training.
- Create an informal atmosphere. Put the audience at ease. Remind people attendance is recorded but no tests will be given..
- Introduce yourself, and conduct audience introductions if necessary.
- Remember to encourage participation so that the class will most benefit from the class.

Review of Session 2

Show Slide 3 - 1 "Main Points of Session 2" and review the following points.

Ask the following points in question format and check the audience comprehension of the material covered in session 2.

- Why is standardization important in TPS?

  -Without standardization there is no baseline upon which to measure improvement.
  -Without standardization quality, safety, cost, productivity etc. will vary.

- What are work standards, and how do they function in TPS?

  -Work Standards form the basis for the manufacturing process.
  -Work standards support the pillars of TPS (JIT & Jidoka)
  -Work standards aid in the creation of standardized work.
  -Examples include: In-Process Check Sheets, Operation Instruction Sheets Job Procedure sheets, Tooling Drawings, Process Condition Sheets, etc.

- What is standardized work?

  -Standardized work is a tool used to conduct continuous improvement.
  -Standardized work forms include: Process Capacity Sheets, Standardized Work Combination Tables, & Standardized Work Chart.

- What is job instruction?

  -Job Instruction is a structured methodology for teaching work
  -The Job Breakdown Sheet is the primary tool used in job instruction.

Main Emphasis of Session 3

Today we will be covering the following topics in more detail

- Ideal conditions for establishing standardized work
- 3 elements of standardized work
- Various forms of standardized work
- Process capacity sheet example
- Basics of time measurement

Today we will actually begin to study in more detail what is standardized work and how it supports the Toyota Production System. In particular we will be covering the process capacity sheet and discussion the basics of time measurement.

This session should last about 2 hours depending upon the extent of your questions.

II. STANDARDIZED WORK

The Definition of Standardized Work

Standardized Work is a tool centered around human movement that combines the elements of a job into the most effective sequence, without waste, to achieve the most efficient method of production.

Standardized work effectively combines people, product, and process under the current conditions to improve quality, cost, safety, ease of operations, etc. Furthermore, it forms part of the base for Just-In-Time production by preventing over-production. Finally, standardized work functions as a basis for comparison enabling us to drive meaningful continuous improvement.

In manufacturing if we focus only the machinery and equipment, there is a strong possibility that we will ignore the role of the employee. For example, isolation of workers by poor layout, or creating unbalanced cycles with varying waiting time implies a disrespect for the human element in the operation. Planning work areas only around machine cycle times will not lead to the most efficient usage of man, machine, material, & method. For this reason, standardized work is created with the emphasis on human motion.

Since standardized work forms a basis for work improvement, it should never be concrete or inflexible. Periodically standardized work should be changed to represent improvements, or reflect changes in takt time. Therefore, standardized work needs to be established by the most experienced people, at the actual work site, who have the best knowledge of work site conditions. Also, Team Leaders and Manufacturing Managers need to manage standardized work and make sure that it is up to date and functioning properly.

Once the most effective repetitive work pattern has been established, it is important to strive to perform it the same way and not engage in unnecessary movements or wasteful effort. Standardized work functions to help maintain quality and efficiency while assuring safety and minimizing equipment damage.

The Usefulness of Standardized Work

This section will explain the role that standardized work plays in the active implementation of the Toyota Production System. Standardized work is a means for setting work methods for achieving cost reduction, building quality into the product, and establishing a manufacturing system flexible enough to accommodate change -- all of which are goals of the Toyota Production System.

Standardized work has four main advantages.

First, since standardized work is calculated based upon takt time, and helps to prevent overproduction. In other words, once takt time is set, it serves as the standard for synchronizing the production of required goods. Since this time is calculated by dividing the time available for manufacturing with the actual customer demand, individual job content and sequence can be balanced with respect to takt time. This prevents the production of more goods than can be sold.

Second**,** standardized work contributes significantly to the production of high-quality products at each process. By determining work sequence and standard work in-process, human variations to the process are minimized. Furthermore, the basic tasks now become part of a repetitive natural cycle. This repetitiveness eliminates frequent stops and starts that are uncomfortable, unsafe, and introduce potential variation to the process. Work performed in a repeating sequence helps stabilize, maintain, and control quality. Furthermore, with standardized work, even if a defect in quality is created, the cause can be more readily discovered and countermeasures against recurrence can be more easily taken.

Third, standardized work produces a product at a considerably lower cost. Standardized work regulates the method of work, or work sequence, into safe, uniform movements without waste. This standardization leads to stable and accurate work. Properly used, standardized work helps determine the correct number of employees in a given work area. Additionally it can help reduce breakdown of equipment and tools, and thereby improve the operational rate. Correctly setting the job sequence and area covered by each employee will aid in fairly distributing work among the team. This effort will also be useful for reducing excess temporary labor or reducing over time . A stabilized method of work will also reduce unnecessary stock inside and outside the process.

Fourth, there must be some basis for judging what is normal and abnormal at the production work site in order to detect problems during operation. If work conditions continually change, it is difficult, without some standard of judgment, to evaluate the results of the change. Standardized work provides this basis for comparison. Correctly applied standardized work also provides a method for determining what sorts of change is needed to help improve the efficiency of a work process. Thus, the establishment of standardized work permits any employee to discover problems in work and is a tool for continuous improvement.

Establishing Standardized Work

In order for it to be effective, standardized work must be created at the actual work site directed by the team leader, with participation of the production team members. Standardized work should not be determined by other departments, engineering, upper management, or written in an office. If a person who is unfamiliar with the actual work site conditions establishes standardized work, it is unlikely to be accurate. Furthermore, when anyone from outside the direct production area creates standardized work it will likely be resisted by the production team and hinder any efforts aimed at true continuous improvement

The team leader's job is to create the most efficient work combinations balancing the demands of the production schedule with the available man power hours for each month. Since production quantity may vary somewhat every month, standardized work must be checked and adjusted according to the actual production needs. Also, modifications in standardized work are often necessitated by continuous improvement suggestions by individuals.

When changes such as this occur, the team leader and team can change standardized work by altering its contents to improve in areas such as quality, efficiency, and safety. In this way, the production team, under the guidance of the Team Leader can establish or adjust standardized work at their own discretion.

Ideal Conditions for Standardized Work

Standardized Work is structured so that production Team Members can concentrate on doing a synchronized, value added-task. We will now study some of the prerequisites needed for Standardized Work.

Show Slide 3 - 2 "Ideal Conditions For Standardized Work"

For standardized work to function most effectively several conditions must exist to some extent. Briefly I will now explain these conditions.

1. From a work point of view, standardized work should be:

   - centered around human movements
   - contain a repetitive job sequence

2. From an equipment point of view, there should be

- minimal trouble with machinery or equipment
- minimal fluctuation in the operation of equipment or the production line

3. From a quality point of view, there should be

- minimal trouble in process quality
- minimal trouble with material & parts

Note: Toyota created standardized work internally after many of these basic problems were largely (but not entirely) solved in production. Attempting to implement standardized work when these problems exist and are not addressed usually leads to frustration and failure.

<u>Conditions to Consider When Establishing Standardized Work</u>

The Importance of Human Motion

One of the most important conditions to be considered when establishing Standardized Work is that it should be centered around human motion.

The central object in pure Standardized Work is the work of the team member, not the machines.

In order to achieve our required production demand in the most efficient manner, we must first consider how human motion is best suited in an environment where each piece of equipment may have a different cycle time.

Allowing human motion to be dictated by unbalanced or inconsistent equipment cycle times is bound to cause intensified effort and wasted labor. The work performed becomes less effective in adding to the value of the final product. In addition, making employees captive to equipment shows a relative level of disrespect for our human resources which are ultimately our most important resource.

For this reason we set standardized work based around the movements of the team member. Only then will we be able to eliminate waste, unbalanced work conditions, and fluctuations in performance.

The Necessity of Repetitive Motion

It is difficult to establish a standard if the task is not done the same way each time. If movements are different in each cycle, or if working conditions constantly change, the standard will no longer function as a basis for comparison.

Since manufacturing consists of repeating the same actions over and over, each action can be standardized. Only when motion is repetitive, safe, and consistent can standardized work be used to achieve its maximum benefit.

Necessary Operational Conditions

Next, I'd like to discuss the conditions necessary for Standardized Work to function to its full potential after it has been established. Operational conditions must be examined from two sides: equipment and quality.

Necessary Equipment Conditions

Much of the work in manufacturing consists of human workers in combination with automated, self-cycling equipment. Since standardized work functions best when in a repetitive cycle, it is critical that equipment be up and running nearly all the time. When equipment is down, this disrupts the natural flow of motion and destroys the normal pattern of job sequence. To ensure that the maximum benefits from standardized work are achieved, it is important to determine the root cause of machine stoppages and prevent them from recurring.

Similar to equipment reliability is the situation with quality. If defective parts are constantly stopping the line, it is extremely difficult to maintain a smooth repetitive job sequence. Defects created in the line, or parts and materials from outside the work area, can both play a very disruptive role and prevent the maximum benefits of standardized work from being achieved. The causes of quality problems need to be diligently researched and carefully resolved when implementing standardized work.

No work area is perfectly free of equipment or quality troubles. Existence of such problems is not an excuse to avoid implementation of standardized work. Once created, however, problems with respect to quality and equipment need to be addressed as they occur to ensure the fullest benefits from standardized work.

Establishing Standardized Work

As I stated earlier, standardized work must be created at the actual worksite using real parts and equipment. Standardized work should be created by experienced personnel under the direction of the Team Leader. Standardized work created outside of the work area and devoid of team member input is likely to be inaccurate and of little use. Standardized work should be understood and practiced by all team members in a given work area. As new thoughts or creative ideas arise with regard to work content or sequence, they need to be evaluated with respect to current standardized work. Any changes that represent some form of improvement can be changed with the approval of the Team Leader.

The most common reason for changing standardized work is due to changes in takt time. Production volumes change slightly from month to month and gradually from year to year. As these changes occur, it is necessary to evaluate the net value added work being performed in an area and determine to what extent standardized work should change. Furthermore, as prices are driven down by the customer, we need to incrementally reduce the waste in our manufacturing system and enhance our ability to compete at a profitable level in the future.

3 Elements of Standardized Work

At this time I'd like to discuss the 3 essential components that make up standardized work. They are: Takt Time, Work Sequence, and Standard Work-In-Process. We refer to these as the "3 Elements of Standardized Work".

Show Slide 3 - 3 "3 Elements of Standardized Work"

- Takt Time
- Work Sequence
- Standard Work-In-Process

Next I will present a brief description of each of the three elements and their relation to standardized work.

Takt Time

Takt time is a time value that tells us the rate at which "a single product should be produced". This time value is derived from the monthly production volume and the hours of operation in that period. Specifically, we divide the available work time in an 8 hour shift by the production demand numbers.

Show Slide 3 - 4 "Takt Time Calculation Example"

- Write the formula for calculating Takt Time on the board. Do an example so that everyone understands the calculation for takt time.

Takt time allows us to produce the large number and wide variety of parts necessary to build products according to our production plan. It helps us supply products to our customers with proper timing without excessive inventory. In this way we can achieve waste-free production.

Takt time is a basic time value which allows us to synchronize the production process with the volume of sales. If all processes, including those done by our suppliers, produce according to takt time, we can produce “what is needed, at the time it is needed, in the quantity that is needed.”

Question: *What kinds of problems would occur if we were to ignore takt time in production? (In doing so, give them a firm understanding of how important it is to maintain takt time.)*

Work Sequence

In manufacturing we convert raw materials into finished products. As part of the process, the operator in a work area has to handle a variety of parts and materials. The worker may carry things, place an object in a machine, remove it from a machine, etc. This can be done most efficiently and safely if the worker adheres to a standard work sequence.

Show Slide 3 - 5 “ Work Sequence”

Question: *Which of these two layouts has the better work sequence? Why?*

- Discuss the possible problems that could arise if the work sequence was not “standardized”. By doing so, make them aware of its importance.

  - Examples of possible problems:
    Injuries and accidents;
    Damage to machinery, equipment, jigs and tools;
    Defective products, and resulting repairs;
    Fluctuation in work hours (performance);
    Number of remaining unfinished products in process;
    Poor workability.

If the Work Sequence is clearly outlined and standardized, there should be no occasion when a worker performs his/her tasks at random. Even if another worker is assigned to a task, problems will be less likely to occur because the working conditions are basically the same.

As is apparent from our discussion, disorderly work can cause problems. For example, team members may forget to perform a process or install a wrong part. Subsequently, a defect may be passed on the downstream process.

A standardized work sequence showing how tasks are to be performed should be posted at the work area. It should be a clear diagram that anyone can understand and follow. This is the origin of the Standardized Work Chart which will be discussed later.

Standard Work-In-Process

Standard Work-In-Process refers to the minimum number of unfinished products required for smooth completion of a work sequence prescribed for a given purpose.

If a worker's range of work is limited to operating one piece of machinery, there is a tendency to have too many unfinished products on hand. This is because processing is performed according to the capacity of the machine.

By focusing on takt time, the worker's range of work can be broadened. He/she can be put in charge of multiple machines. As a result, the production method changes from one based on the capacity of machinery to one based on takt time. This eliminates the necessity of having large numbers of unfinished products. We only need to produce in accordance with what takt time demands.

When individuals handle multiple pieces of equipment there is still the possibility that much work in process can be built up. To avoid this situation, standardized work contains an element call standard work in process.

Standard Work-In-Process varies depending upon the work sequence and layout of machinery and equipment. For example, there will be different quantities of unfinished products depending upon whether we work with the flow of a process or against it. Next I will use some graphic examples to illustrate this point.

Show Slide 3 - 6 "Basics of Standard Work-In-Process"

- Explain the basics of Standard Work-In-Process, taking into consideration the flow of the processes and the presence/ absence of automatic feeders.

Show Slides 3 - 7 & 3- 8 "4 Main Combinations Of Standard Work In Process"

- Describe the four patterns in order.
- After explaining the four patterns, conduct practice problem to check comprehension..
- At this point, reconfirm the key guidance points regarding the basics of Standard Work-In-Process.

- What possible inconveniences could occur if Standard Work-In-Process is not set?
- At what point in the working sequence should we determine the setting of Standard Work-In-Process Stock ?
- What are the merits of setting Standard Work-In-Process Stock?

Standard Work-In-Process refers to any unfinished products. For example, pieces mounted on machinery, on jig-mounted conveyor belts sitting in a queue between 2 workers, or parts in a cooling station.

Lower amounts of Standard Work-In-Process makes it easier to control quality. It also helps improve workability and safety.

Takt Time, Work Sequence and Standard Work-In-Process are important in their own right. Each plays a big role in the Toyota Production System. The team leader does not set takt time, however, the team leader is responsible for and has the authority to determine the Work Sequence and Standard Work-In-Process, with the participation of the team.

The team leader must have a thorough understanding of these three elements. If he/she does not, Standardized Work cannot be done properly, and various problems may arise.

A disorderly Work Sequence affects Standard Work-In-Process, since it may change the work time and cause fluctuations in quality. This may result in defective parts being produced. The team leader needs to take into consideration the proper operation of these three components when developing standardized work at the worksite.

III. Creation Of Standardized Work

Forms Used in Standardized Work

Standardized Work is the basis used for manufacturing at the worksite. It specifies how to proceed with one's work. There are various forms to help establish practical methods.

Show Slides 3 - 9 "Various Forms For Standardized Work"

- Process Capacity Sheet
- Standardized Work Combination Table
- Standardized Work Chart

- Each form/chart will be discussed in detail later.
- Ask about the forms that the participants are currently using in their worksite.

Explanation of Exercise

Now let's discuss the purpose and use of these forms. Before doing so, I will explain a sample manufacturing process to help you understand how these forms are used.

Show Slides 3 - 10 "Sequence Of Process"

- Explain the following : Part number, part name, work name, contents of work, process sequence.
- Explain that this sample manufacturing process will be used throughout the course.
- Explain the reason why this example was selected:

  - All the basics of creating the various Standardized Work forms are explained clearly.
  - TPS Standardized Work was originally created in this type of machining process. (The need for it is clearly shown).
  - It is easy to understand the combination of man and machine.
  - It is the best practice example we have so far.

Preparing Process Capacity Sheets

The Process Capacity Sheet shows the production capacity of each process involved in producing a part. In this sheet, the time required for manual work, for automatic feed of machinery, and for exchanging tools are entered. This Process Capacity Sheet serves as the basis for preparing the Standardized Work Combination Table. With this sheet, it is also possible to easily locate a problem or bottleneck process from among all the processes.

- Distribute the capacity sheets. Read aloud each column. Give them an understanding of the format of the sheet.

Instructor Note: Review the instructions on the following page on how to fill out this sheet in advance.

Show Slides 3 - 11 "Sample Process Capacity Sheet".

- Explain the main points.

Show Slides 3 - 12 "Blank Process Capacity Sheet"

- Hand out blank process capacity sheets.
- Onto a blank process capacity sheet demonstrate what to enter for the first machine.

Show Slide 3 - 13 "Exercise Problem"

- Explain the contents of the problem. Then have the audience complete the example by themselves.
- As the participants are filling out the sheet, walk around the room and check their progress.

Show Slide 3 - 14 "Answers Slide"

- After everyone has completed the exercise put up the answer
- Discuss the example as needed.

Instructor notes for filling in the Process Capacity Sheet.

1. Date - Enter the current date

2. Prepared By: / Revision Level / Purpose - Enter name of person filling out sheet. Enter Revision level if appropriate.

3. Part Number - Enter the part number.

4. Work Area - Enter the name of the work area and manufacturing location.

5. Product Name: - Enter the name of the part to be processed.

6. Step # - Enter the sequence number of the production process.

7. Process Name: - Enter the name of each process in the production sequence. This shows how the material or parts are processed and the status of their development. When simultaneously processing multiple parts with a single machine, place (__________) in the process name column and write in the quantity.

8. Machine Number: - Enter the machine number. If there is no machine number, place a hyphen (-) in the applicable column.

9. Basic Operation Time: - Enter the manual work time, automatic feed time, and total cycle time in their respective columns. Since the basic time must be accurate, take measurements (time studies) at the actual work site using actual parts and record the data. The basic time value is the foundation for creating the other written forms.

9a. Manual Work Time (Man Time) - The manual work time is the time an employee takes to perform manual work on equipment or machinery. For example, unloading and loading material in dies, or tightening parts with manual tools. Enter the total manual work time in the bottom column.

9b. Automatic Feed Time (Auto Time) - This is the time from the moment equipment starts operation, through completion of its purpose, such as processing, conveyance or inspection, until it returns to the home position and stops.

9c. Total Cycle Time (Total C.T.) - This is the overall time required for each process or machine to complete its task. Generally, adding the automatic feed time to the manual work time will give the completion time.

Points Of Caution

* Since the major function of the Process Capacity Sheet is to measure machine capacity, do not enter such work as simply removing material from a pallet or placing completed parts on a pallet by hand.

* Do not use a Process Capacity Sheet on a line that only performs manual work. It is an effective written form only for a machine processing work area or paint line, where the production capacity of the machine equipment needs to be measured.

10. Tool Changes - Enter the tool replacement quantity and replacement time.

10a. # Pcs / Change - Enter the standard quantity of parts that are processed before the tool is changed.

10b. Time to Change - Enter the standard time it takes to replace a single tool. This time should be the minimum time.

10c. Time Per Pc. - Enter the amount of the tool change time allocated to the standard quantity of parts processed between tool changes.

$$\text{Time Per Pc} = \frac{\text{Time to Change}}{\text{\# Pcs / Change}}$$

11. Capacity - Enter the maximum capacity (quantity) that can be processed within the fixed period of one shift.

$$\text{Capacity} = \frac{\text{Operational Time Per Shift}}{\text{Total C.T. Per Process + Time Per Pc. Per Process}}$$

12. Comments - Graphically indicate the relationship between manual work time, automatic feed time and total cycle time with a line drawing. Enter any other special matters.

13. Notes - Enter additional information or comments.

Next we will continue with our practice problem by calculating an actual machine capacity.

Show Slide 3 - 15 "Calculation Of Machine Capacity"

- Have the participants calculate the actual machine capacity for each machine.
- Determine which machine is the least capable process.
- Remember no machine is truly a "bottleneck" until it prevents us from achieving the production target.
- Once calculated the capability of the least capable (slowest) machine should be entered onto the Process Capacity Sheet inside the parenthesis.

IV. Time Measurements

It is important to learn how to do time measurements and record them on all the various forms of standardized work. In a later session, you may be asked to measure actual work times on the shop floor. Therefore, I will explain the basics of doing time measurements.

<u>Time Taken Reflects the Method of Action</u>

Explain how work time is influenced by work methods.

- Examples:
  Assume that you want to buy a candy bar at a vending machine. You get coins ready while waiting in line, then when your turn comes, you put the coins in immediately, make your selection and buy your candy. The time taken to do this is eight seconds.

  Assume that another person takes his coin holder out of his pocket when his turn comes to buy his candy. He takes out the coin, puts it in the machine, takes out another and puts it in the machine, and so on. Assume that in this case he also drops a coin, looks for it, finds it and puts it in. This takes a total of one minute.

- If you use a fine piece of sand paper a longer time is required to remove material. If you use a coarse grit of sandpaper initially a shorter time will be required. (Of course finish specs might require still also using the fine grit at the end!)

- Give other examples and have trainees understand that the time taken to do a job varies considerably depending on the way the job is done.

Time taken to do a job varies depending on the work procedure, the tools used, the way in which preparations are made, etc.

Main Point: The time taken reflects the method of action.

The present time taken to do a given job should not be considered the optimum time. It is not always invariable; it can be changed freely by changing the work conditions. Time needed is influenced greatly by how the job is done, hence you need to study the work conditions of each process. Study various ways to improve the operations and draw up a plan.

Outline of Time Measurement

Time measurement involves breaking a job down into work elements and recording the time value for each element. In Standardized Work, it is necessary to measure the manual work time and automatic time used in the Process Capacity Sheet. We also measure the time for each work element that is part of manual work such as assembly.

Measuring Points

Time measurement is performed after analyzing and determining the work elements. Before you can do any time measurement, it is important to know when to start timing. The instant at which this measurement is performed is called the "measuring point".

If you are inconsistent, your data will be unreliable. To avoid ambiguity, we make the measuring points the "instant the work element is begun and the instant it is completed."

Main Point: *You must agree upon the measuring points before you begin to conduct any time study*.

Let's do an exercise so that you can get a better understanding of determining work elements and identifying measuring points.

- Explain that you will perform a job for three cycles so participants can determine and record each work element. Instruct group to watch the work you perform, determine the work elements, record the work elements on paper.

- Perform a job (such as the one outlined on slide 3-16) for three cycles. *Note: Be consistent in work sequence. Caution: Do not talk too much and give away the answers.*

- After three cycles have been completed, stop the exercise, and assess the group's progress.

Question: *How many elements did you establish for the job?*
How did you describe the work elements?

- Poll the group to determine the range of the answers.

Show TP 3 - 16 "Practice Analyzing Work Elements"

- Summarize the work elements :
    1. Stand up.
    2. Walk to the flipchart.
    3. Pick up the marker.
    4 Write something.
    5 Put down the marker.
    6. Return to your seat.
    7. Sit down.
    8. Sitting.

Now that we have established the work elements of the job, we need to determine the measuring points for the job. Measuring points can be based on things you see (such as pushing a button) or hear (clicking sound as a part is inserted).

- Explain to the group that you will perform the sequence listed on the flip chart for two more cycles as part of a demonstration. They should observe and record measuring points for each work element. Perform two cycles of work.

- Ask group what measuring points they identified for each work element.

Show Slide 3-16 "Stand Up, etc."

- Write the measuring points on **Slide 3 - 16**

    1. Stand up. ***(Standing)***
    2. Go to the flip chart. ***(Stop)***
    3. Pick up the marker
    4 Write something.
    5 Put down the marker. ***(Sound of marker on easel)***
    6. Return to chair. ***(Stop)***
    7. Sit down. ***(Back touches chair back)***
    8. Sitting. ***(Start to stand)***

- Explain each measuring point. Go through the motions. Demonstrate each measuring point (instant at which each work element is completed).

- Point out that short duration work elements can be combined with longer work elements during time measurements.

- Have the group estimate how long it takes to pick up the marker and put down the marker. These elements are short and can be combined with the “Write something” element.

Question: *What other work elements are short in duration and possibly could be combined with another task?*

- Explain the work should be broken into four work elements.

- Using the flip chart, summarize the work elements to be measured.

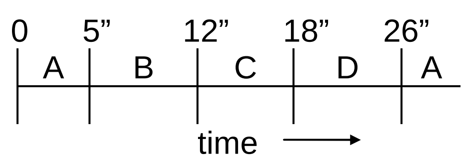
  1. Stand up; Go to the flip chart
  2. Pick up the marker; Write something; Put down the marker.
  3. Return to chair; Sit down.
  4. Sitting.

- Take questions.

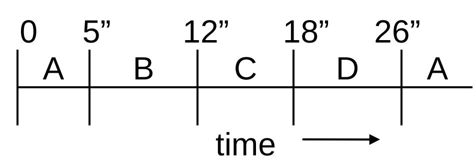
Time Measuring Method

We use either a digital or analog stop watch to perform time measurement. While many stop watches have lap and split functions, Toyota normally uses a continuous time measuring method to analyze work. This means we let the stop watch run ***continuously*** when measuring the time for each element work.

- For example: record the time at measuring points 5”, 12”, 18” and 26” of each work element.



- After completing time measurement for each work element, calculate the time for each element (using subtraction) and record it.



-For example, we started our stop watches at the beginning of work element A. At the end of element A, 5 seconds had elapsed on the watch. The time for this work element is: 5 sec minus 0 sec or 5 seconds.

Calculated times are as follows (example):

Work Element A: 5 seconds
Work Element B: 7 seconds
Work Element C: 6 seconds
Work Element D: 8 seconds

- Accept and respond to questions.

Measuring Practices (Time Permitting)

- Create additional examples relevant for your environment.

Up to this point we have looked at work elements, measuring points, and the process for measuring time. Our next step is to practice, using the stop watches to measure work being performed. This work involves short-duration work elements which can be difficult to measure.

- Refer to four work elements written on flip chart (Stand Up, etc.)

- Explain the method for the practices.
  - Record the time for each element on a piece of paper.
  - Perform the measuring practice four times; Record the measured times in four columns.
  - Calculate the time for each work element.
  - Calculate the cycle time
  - Record results of each practice on the board immediately after that practice.
  - “Start” means “getting up off your chair”.
  - “Stop” means “back against chair”.

- Determine the correct times for each practice by listing several trainees’ times on the board. Agree upon most accurate time.

Outline of Time Measurement of Work

The actual work you are doing in your worksite is more complicated than this exercise. The scope of work in multi-process handling is wider and involves many work elements. Variations in motion may occur and exceptional work may be required depending on the kind of work performed.

Now let's discuss the procedure for efficiently performing time measurement. This method is based on our experience. Use it as a starting point for devising more efficient methods.

Show Slide 3 - 17 "Plant Floor Observation Methods"

1. We just talked about the procedure for measuring cycle time. Use it when performing time measurement at your workplace. Time measurement is the same as analyzing the present situation or method. Be sure to look at the facts as they are. Leave nothing out; do accurate work.

V. Closing The Meeting

Today we have covered a variety of topics. We have finally entered the area of standardized work, learned some critical conditions that relate to standardized work, and introduced one of the forms of standardized work. Let's take a few moments and review some of the main points of session 3.

Show Slide 3 - 18 "Main Points Of Session 3"

Ask the participants the following questions to check their understanding of the topics covered in session three.

Question 1) *What are the ideal conditions for establishing standardized work?*

Answer: Centered around repetitive human motion,
Minimum equipment trouble,
Minimum quality trouble.

2) *What are the three elements of standardized work?*

Answer: Takt Time, SWIP, Work Sequence

3) *What is a process capacity sheet used for?*

Answer: Identifies production capacity of each machine.
Highlights least capable process.

4) *What are some of the key points of time measurement?*

Answer: Time reflects method, work elements must be agreed upon first, measuring points must be determined.

This concludes session 3 of TPS standardized work. Tomorrow we will continue with more of the forms used in standardized work.

Thank you for your participation.

Please remember to be on time to the next training session.