STANDARDIZED WORK

1ST SESSION

STANDARDIZED WORK AND WORK STANDARDS - SESSION 1

AIM	(1) Recognize the Role of a Leader in TPS (2) Review Basic Corporate Philosophy and TPS Philosophy (3) Understand the Background and Goals of TPS

TITLES AND CONTENTS

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Things to Prepare

1	Instructors Guide, Participants Guide
2	White Board, Flipchart
3	Laptop, LCD Projector, Screen, Pointer
4	
5	

Items to Distribute

1	Participant Text
2	
3	
4	

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Standardized Work – Session 1

Standardized Work

Instructor's Guide

I. Opening the Meeting

Introduction and Greeting

- Opening remarks from Operations department, or area manager. Introduction of the instructor. Opening statement.

I am (*name*) of the (*depart*. or *area*) at (*location*). We will be studying the topics of Standardized Work and Continuous Improvement. These are important concepts that form a vital part of the Toyota Production System. Keep in mind however this is only a small part of the Toyota Production System overall. I look forward to working with you the next couple of hours days.

This course is primarily designed for Team Leaders and other basic leadership positions in manufacturing, and consists of 5 two hour sessions. Today we will just cover session one and some of the most basic concepts of the Toyota Production System. I'd appreciate it if you would please give me your full attention and cooperation. Feel free to ask questions when necessary. Let's try our best to make this a worthwhile course and improve our understanding of the subject matter.

- Create an informal atmosphere. Try telling a joke or personal story. Put the trainees at ease.

- Note that attendance is recorded but no tests will be given. Point out the necessity of coming to class on time. Encourage participation.

- Self-introductions to include: 1) Name, 2) Workplace, 3) Type of work, 4) Number of team members*, 5) Familiarity with TPS.

- Introduce visiting attendees as necessary. Today we have (name) of the (area/dept.) at (location).

- Discretely inform visitors or non class participants that they are welcome to listen but to please refrain from comments or other actions that will disrupt the proceedings of the class.

Definition of a Leader

QUESTION: What is the role of a Leader? (Discuss)

There are many answers to this question.

Show Slide 1 - 1 "Role of a Team Leader"

During this course I will use the word "leader" frequently. I will use this term from now on to mean:

- someone who looks after other people
- someone who guides the work of others
-someone responsible for solving problems or making improvements

All of us here today are leaders in different respects.

KEY POINT: Make sure everyone in the room realizes they are a leader. If you are teaching a class of Team Members, this point is not as urgent.

Role Of Management and Team Leaders

In manufacturing we are constantly dealing with a variety of problems. Typically these problems adversely affect Quality, Cost, Safety, Productivity, etc. These problems require constant attention above and beyond that of daily schedule attainment. It is the responsibility of leaders to take a proactive role in dealing with problems.

Workplace Problems and Improvement

All of us as leaders and team members are concerned about problems in our workplace. Left unattended, problems affect safety, productivity, cost, quality, and morale. As leaders (and team members) it is part of our job to continually look for ways to solve problems and make work place improvements.

QUESTION: What problems do we typically see on a daily basis in manufacturing?

- Ask the trainees for actual problems they face in their jobs. If participants do not volunteer problems freely, see questions below to prompt responses.

- List problems on the flipchart.

KEY POINT: Try to solicit problems related to safety, cost, quality, etc. Do NOT write down complaints, frustrations, vague, or general statements such as leadership, or communication. Stick to topics in the realm of control of manufacturing.

- Below are some questions to help elicit responses relative to problems in the work place.

    1. What problems do you have related to quality?
        - dimensional accuracy varies randomly.
        - breakage, scratches, sinks, dirt inclusions, etc.
    2. What problems do you have related to cost?
        - consumables are wasted, excessive stock, etc.
        - scrapped parts
    3. What problems do you have related to safety?
        - cuts and scratches
        - pinch points, cluttered areas
    4. What problems related to lead time and inventory?
        - lot size is too big
        - excess inventory
    5. What problems do you have related to the work itself?
        - unnecessary walking
        - waiting time exists
        - random variations in the work load
    6. What problems do you encounter related to machinery and equipment breakdown?
        - frequent stoppages
        - long periods of down time
    7. What problems do you have related to process?
        - poor stability or documentation
        -doing 100% sorting or inspecting.

- Write 7-8 concrete examples of problems on the flipchart; they will be used later in the course.

We've discussed various kinds of problems. Each day we as leaders deal with these and many other types of problems. During this class we will learn that it is necessary with respect to problems to ensure that the right type of standards and standardization are in place in our work areas. Standards are the basis for solving a problem. Without a standard as a basis for comparison it is very difficult to solve problems or conduct any form of continuous improvement.

II. TPS & Leaders

A leader is responsible for various aspects of the production process, such as quality, cost, safety, productivity, customer demand, etc. Therefore, he/she must thoroughly understand the elements of TPS and making improvements. All our leaders must be able to develop, implement, and manage improvements in their areas.

Five Pre-Requisites For Team Leaders

During this course you will learn that there are five basic types of knowledge and skills required of a leader. Let's take a look at their relationship to TPS.

Show TP 1 - 2 "TPS & 5 Needs of a Team Leader".

- Explain the relationship between the five conditions required of a leader and the Toyota Production System.

1. Knowledge of Work (Show Slide 1 - 2*)*

Knowledge of Work means knowledge concerning materials, machinery, processes, methods, and necessary kinds of technologies concerning manufacturing, etc. This kind of knowledge is required in an ever-changing workplace.

Being a leader involves know-how; skill in combining materials, machinery, and workers for maximum efficiency. It requires practical knowledge of the workplace. The Toyota Production System cannot be used effectively until the processes, manufacturing methods, and other necessary technologies are understood. This kind of practical knowledge of work is a very important requirement of a leader working within the guidelines set by the company.

2. Knowledge of Work Responsibility (Show Slide 1 - 2)

Knowledge of Work Responsibility pertains to understanding one's responsibility and authority as a leader in manufacturing. It includes an awareness of the need to perform work according to company policy and the ability to meet production demands in accordance with customer and in-house requirements.

In the Toyota Production System we are asked to produce the necessary amount of parts to meet the production schedule. It is our responsibility to accomplish this by running to takt time, producing quality parts, and constantly looking for ways to reduce waste. Understanding our responsibility and the tools in the Toyota Production System can aid us in achieving our area's goals.

3. Skill in instructing (Show Slide 1 - 2)

Instructional skill is necessary in order to provide adequate education and training for team members. Most of what we accomplish in manufacturing is through the efforts of our team members. Proper teaching skill requires an understanding of Job Instruction methodology and the ability to apply it when teaching with job breakdown sheets or standardized work charts.

Teaching skills are important for many other reasons as well. First, a leader must foster the development of highly skilled employees. In most companies, each worker is often responsible for a range of different processes and jobs. Thus it is often necessary to provide multi-functional training.

Second, since quality must be built in at each process, it is necessary to provide adequate training. In this way, we ensure that team members understand and carry out their work accurately, safely, and conscientiously. For these reasons, **Teaching Skill** is an extremely important part of the leader's role in the Toyota Production System.

4. Skill in Improving Methods (Show Slide 1 - 2)

To be successful in achieving company goals and objectives in the work place, leaders must be skillful at doing continuous improvement and eliminating waste. This skill requires being able to analyze and simplify work in order to raise efficiency, improve quality, ensure safety, lower costs and improve morale.

As part of the Toyota Production System, we create Standardized Work to analyze, simplify, and improve work methods. It is a key starting point for making improvements. Using Standardized Work as a guide, we can determine the most effective work sequence and the resources needed to produce efficiently .

5. Leadership Skill (Show Slide 1 - 2)

Being skillful at developing and leading people is important. To be successful as leaders in manufacturing, we have to understand the company goals and objectives and how they translate to our areas.

The Toyota Production System includes a respect for humanity and the integrity of work. It is a system whereby all team members are asked to participate in the improvement of their work place. We as leaders must be able to guide and facilitate our work teams in the pursuit of continuous improvement.

These are not, of course, the only requirements of a leader, however, they do constitute the basic or minimum conditions for successful implementation of the Toyota Production System.

QUESTION: Why are these skills important?
(What happens if you can't teach, lead, or do CI?)

This course will help you improve your skills mainly in terms of improving work methods. This will also help you become a better leader. A separate course called Job Instruction training is used to build fundamental skill in instructing others. Ideally you should have taken Job Instruction training before taking this course.

III. CORPORATE PHILOSOPHY

The Production of World Class Quality Products

Customer demands and style preferences in the automotive industry are becoming more diverse, and sophisticated every day. There is increasing pressure on automotive suppliers to meet these demands through mixed model production, and JIT delivery.

Show Slide 1 - 3 "Basic Aims of TPS"

Given our industry and situation there are 4 basic objectives that we are trying to achieve in TPS. Standardized work can contribute to all of these.

1) Provide the highest possible quality and service to the customer
2) Develop employees potential based upon mutual respect and cooperation
3) Eliminate waste in all aspects of production activities
4) Develop a flexible production site that can respond to changes in demand

Only by focusing on all of these objectives will we be able to ensure the company's success and survival in the future. Our customers are demanding that we produce exceptionally high quality while maintaining a competitive price. Additionally we are trying with the use of proactive Research & Development and Product Development, to build products that give us an advantage over our competitors.

QUESTION: What does "high quality" mean to you?

KEY POINT: Lead the discussion to make the following points

Defining "quality" is important because:

- each of us can bring a different meaning to the term "quality".
- it is necessary to define "quality" before studying it.
- "perceived quality" is important to the customer.

- Explain: For the purpose of this class we will classify "quality" into the three following categories.

(Write on a flip chart)

Design Quality - This includes the up front work involved in product development such as concept definition, prototype builds, FMEA, product and tool design, part specification and sourcing.

Manufacturing Quality - This includes all the work we do in production such as set up, changeovers, operation of equipment, assembly, material handling, inspection etc., to build in quality at the process.

Service Quality - This refers to the quality of service we provide to a customer after delivery, for example handling problems, follow up visits, customer contacts, etc.

This class is designed mainly for leaders in manufacturing, and so we will primarily be focusing our attention on **manufacturing** quality. In manufacturing we must carry out activities that ensure quality is built into every product that goes out our door. Of course other parties in the company are working on their respective pieces of the process as well.

- Use problem list previously put on flip chart. Point out that a lot of these problems relate to manufacturing quality and standards.

Customer Satisfaction

Now let's consider production and our products from the standpoint of "customer satisfaction". History shows clearly that a manufacturer must do adequate market research and take into account the needs of the customer. This is done to meet diverse requirements in a very competitive market. In the past, the only requirement of our products was that it functioned properly, however, the situation has changed. Our products must meet a wide range of customer needs and preferences. We must be concerned with ease of operation, ease of installation, JIT delivery, reliability, low cost, styling, appearances and expanding technology. Keep in mind what we have just talked about is the meaning of "quality". Let's consider why we must strive to produce on the basis of a "customer satisfaction" way of thinking.

QUESTION: What does it mean to have a "customer satisfaction" philosophy?

Sample responses may include:
- high quality products
- low price; trouble free
- quick response to problems
- on time delivery

As your answers indicate, it is vital for us to produce with a customer satisfaction philosophy. Only by building safe, high quality, trouble free, low cost products will we be able to meet the expectations of our customers. In turn, this will enable us to earn profits that will secure our future.

IV. Importance Of Cost Reduction

A. Circumstances Surrounding The Company

In order to continue to obtain a profit in our current markets it is necessary for each of us to understand company policies and objectives while carrying out our responsibilities as Leaders. For this reason it is important for us to fully understand the circumstances and competitive reality that surrounds the company today.

Now I would like for us to take time now to recognize some of the circumstances surrounding the company and reinforce why we need to conduct TPS activities company wide.

Show Slide 1 - 4 Corporate Sales & Gross Profit Level Trends

Create this chart in advance of class for presentation. Discuss company sales and profit trends.

Show Slide 1 - 5 Overall Quality Trends

Create this data chart in advance of class for presentation. Discuss trends for Scrap, Rework, Customer defects, warranty, etc.

Show Slide 1 - 6 On-Time Delivery

Create this chart in advance of class for presentation. Discuss the current situation with facts and details.

Show Slide 1 - 7 Price – Cost Squeeze

Create this chart in advance of class for presentation. Show the current situation with respect to average price of your products and the average cost on a year to year basis. Discuss company the current situation with facts and details.

Note to instructor: In all four of these areas you should strive to show the current realities confronting the company and the urgency we must all have for solving problems and making improvements. If these slides do not convey the message then please create your own set that does set this tone.

B. Pursuit Of Profit

Next we are going to talk more about the pursuit of profit in manufacturing. It is vital for all leaders and employees in manufacturing to understand the importance of profit and structure of cost.

As we briefly touched on before it is vital for the company to balance the needs of its employees, the needs of its shareholders, and the needs of the customers, and suppliers. Obtaining a continued profit is of foremost importance to all the above stakeholders.

In order for the company to obtain a profit, equal effort is required from management and production employees. Let's take a moment and think about how we secure a profit.

In particular, let's look at the components of profit: sales price and cost.

Show Slide 1 - 8 "Cost Plus & Reduction Principles"
and explain the two ways of looking at cost.

- Next write the following equation on the flip chart.
  Profit = (Sales Price - Cost) X # of units sold

Question: Given this equation, what are the ways to increase profits?

- Write the 3 following ways on a flip chart (after audience states them)

1) Increase sales price
2) Increase the number of units sold
3) Lower cost

KEY POINT: After explaining the above 3 ways explain the following points.

Method 1: Raising Price

1) Explain that sales price is ultimately decided by the market place.

   -Competition leads us to competitively set our prices.
   -It is hard to raise prices. Often decreases are expected.

You can only raise price to increase profit when you are a monopoly, or have a unique, highly desired product or service that others can not easily duplicate. Even when possible in the short run this is not a viable long term option for most companies.

Method 2: Increase the number of units sold

Discuss the current possibility of selling more units in the market. Normally the following two points apply. Discuss as applicable:

1) There is a limit to our ability to produce in the short term.

    -For example equipment limits our capacity.

    -Also it is hard to suddenly change schedules.

2) In the long term we can't control the market place.

    -Without special distinguishing features it is hard to increase demand for our products.

    -We can't just make as many parts as we would like and sell them.

Method 3: Reduction Of Cost

1) We can, however, alter our production method to lower costs.

    -Effectively use machines, equipment, material, parts and labor.

    -Only produce what is necessary.

2) Eliminate all elements related to production that do not add value

    -Reduce waste.

    -Increase the ratio of those items that add value to the customer

If you look at the logic, it becomes apparent that it is hard for us to raise our prices, or unilaterally set our sales volume to try and increase profits.

As leaders directly involved in manufacturing, it is necessary for us to focus on cost reduction through activities involving all our employees.

Note: As applicable mention when other sections of the company are working on cost reduction as well, not just manufacturing. For example product development is working on VE (Value Engineering), and other teams are working on VA (Value Analysis). Purchasing is holding down material prices, and others are making efforts as well.

C. Manufacturing And Cost

1) Now we will discuss the cost structure of manufacturing.

The percentage of cost that manufacturing occupies is only a part of the total cost of an item, and it is not easy to calculate.

The total cost of an object is made up of various costs such as purchased parts costs, material costs, labor costs, energy costs, depreciation costs, overhead costs, etc.

Show Slide 1 - 9 "Cost Structure (top half only)" and explain the contents of sales price.

Usually when asked about costs, materials, capital and labor usually come to mind. However, once we have purchased the equipment, capital costs are a fixed cost that manufacturing can not directly alter. Additionally, labor costs in manufacturing are generally less than 10% of the total cost of manufacturing a product.

So how does a company make more money in manufacturing? We've shown that we can't raise price, or alter the number of units sold. In manufacturing the only path available to us in manufacturing is to focus on the *way we manufacture*. We have to constantly focus on eliminating every little bit of waste in the entire system.

2) Now we will discuss some of the elements that make up cost

QUESTION: What actions lead to increased costs in your work areas?

Examples of answers

-Labor
-Overtime
-Materials
-Scrap
-Machine Downtime & Breakdowns
-Waiting, Walking, Or Other Non- Value Adding Motions
-Inventories Of Work In-Process & Finished Goods Inventories
-MRO items
-Part Shortages and expediting

All of these influence cost in manufacturing and are waste.

3) Now we will discuss motions & activities that do not add value

As we just highlighted, there are many types of motions and activities that do not add value in manufacturing. In the Toyota Production System we frequently mention the concept of waste. Waste is anything that does not add value from the customers point of view.

In general any task can be looked at an analyzed in different ways. The key insight however is to realize that little of what actually goes on in a typical manufacturing site is truly value added from a customer point of view.

A primary learning goal in TPS is to train people to recognize what is the true value add in any process and what is the non value added waste. Some actions are pure value added form the customer point of view. Others are wasteful but required in the current process due the way we perform the job. Other tasks however are completely wasteful and should be avoided at all costs.

Over the years the types of waste have been summarized into the following several categories.

List these items on a flip chart.

1. Overproduction
2. Inventory
3. Transportation
4. Excess motion
5. Rework and scrap
6. Waiting
7. Excess processing

Discuss an example of each of these with the class from the groups experience.

Draw and review the pie chart depicting the relationship of value add, incidental waste, and pure waste for a brief summary.

D. Product Development & Engineering Capability

Of course it is not possible for us as leaders in manufacturing to reduce all costs in the manufacturing system. Many things are out of our direct realm of control. Materials, and purchased components are specified and controlled by other departments. Supplier performance affects our areas daily. Initial product development and design often lock in 70% of

the cost of an item before we even begin planning for launch in production.

Show Slide 1 - 9 "Manufacturing Cost" (Bottom Half) and explain the common components of cost.

This graphic depicts a different way to think about cost and activity. There are some actions in production which truly add value to the customer. There are some actions which are incidental – in other words they don't add value but are required by the process in the current state. And there are some actions that are pure waste! We should strive to maximize the value added work in our areas, minimize the incidental work, and eliminate the wasteful activity.

It is important to notice that even though we as leaders in production can't directly control all these items, we can still accomplish substantial savings by using our human capacity for creativity, and common sense. Through our collective efforts with other groups we may be able to influence these or at least hold them at current levels.

For leaders and employees in manufacturing it is vital for us to understand cost because it directly affects our profits and performance.

QUESTION: Why do some companies make more money than their competitors?

Ask 2 - 3 people the above question, then explain the following.

One reason is because of *superior product or technology*. All companies would like to be in the position where they are the sole producers of a high demand item. Quite often firms enjoy success because they are first to the market, or hold some type of legal patent protection

Most companies have few products, however, that fall into the the category of superior product or technology that can command some type of high profit niche. The vast majority or companies have to rely upon being more *efficient* in order to make a profit. Unless you truly have a product that no one else can duplicate, eventually competitors enter the picture, patents expire, or other forms of protection expire.

Being more efficient in production means focusing on the way that we produce and learning to reduce waste. Advantages can stem from labor efficiency, material efficiency, yield efficiency, and numerous other areas as well. The majority of our actions and motions do not add value to the final customer. Finding ways to eliminate these wastes or non value added activities is a key determinant in our success as a company.

As I have tried to explain, it is very important for us to obtain a profit as a company. In most areas we don't enjoy a monopoly position, so it is important for us to make a higher quality product than our competitors, at a lower cost, efficiently using what equipment, machines, materials, and people we have.

Up to now, I have talked about the general importance of manufacturing methods and development activities. Next I would like to discuss more specifically components of the Toyota Production System.

V. Aim of TPS

Our fundamental philosophy is to provide products at world class quality levels to meet the expectations of our customers, and to be a model of corporate responsibility within our industry and community.

4 MAIN GOALS OF TPS

Show Slide 1 - 10 "4 Main Goals Of TPS"

A. PROVIDE WORLD CLASS QUALITY & SERVICE

A major intent of TPS is to, "*build quality in at each and every process".* This principle gives each team member the responsibility and authority to check their own quality at each stage of the process, and to stop the line at the first sign of any abnormality.

In manufacturing or service work, mistakes or poor work practices can lead to faulty products, which in turn will have devastating consequences for our company.

Achieving high quality must be given priority. Neglecting quality can never be excused, therefore it is necessary to have a system of checks to verify quality.

One method we can use to ensure quality by reducing variation is by implementing *"Standardized Work*" which we will study in great detail over these five session. By standardizing work practices across all shifts and team members, we can reduce the potential for variation that may result in defects or other problems.

B. DEVELOP EMPLOYEE POTENTIAL THROUGH MUTUAL TRUST, RESPECT & COOPERATION.

The second goal of TPS is to establish a worksite based upon mutual trust and respect. In manufacturing we want to ensure that each team member's labor adds value to the product and to our customer. Engaging people in value added work shows respect for the individual's dignity. Conversely, having people spend valuable time doing meaningless tasks shows not only a break down in our system, but also implies a lack of appreciation for employee ability.

In the Toyota Production System, *Standardized Work* is used to ensure That effective production is concentrated around team member movements. Many companies stress the performance of machines at the expense of team members. We want to maximize both the performance of our employees, and capability of our equipment.

In TPS if a team member discovers a problem in their work, they are expected to stop production and notify their Team Leader. This practice reflects respect for the individual's ability and judgment for their work.

C. REDUCE COSTS THROUGH ELIMINATION OF WASTE

The third major goal of TPS is to reduce cost by eliminating waste. TPS attempts to find all forms of waste in each process and then eliminate it. By closely observing equipment, materials, and team members and effectively organizing them in the actual work area, it is possible to uncover large amounts of waste.

Some types of waste are obvious, others are hidden. Waste never improves value, it only increases cost.

Note: Waste = Non value added activities or non value added method

D. DEVELOP FLEXIBLE PRODUCTION SYSTEM BASED UPON MARKET DEMAND

The fourth goal of TPS is to create a flexible work site. TPS attempts to deliver the right item, in the right amount, at the right time. In order to do this we need a flexible work site and short production lead-times.

The basic concept behind the shortening of lead time is to take customer orders, produce as quickly and efficiently as possible, and deliver on time.

Having a flexible system allows for any changes in the process (due to market demand) to be implemented more smoothly, without adverse effect on production operations. Minor changes to production volumes can be handled and problems identified easily so corrective action can be taken.

A strong and flexible production system can help to produce the required items in the necessary time without waste, while coping with minor changes in production quantity. This allows us to meet production schedules and satisfy our customers.

Two Pillars Of The Toyota Production System

As we have just learned, there are four main goals for our production system. In order to achieve these targets against the backdrop of a fluid and diverse market, manufacturing must aim to create a system that is capable of responding in a timely fashion to changes in demand.

As we covered earlier, manufacturing is not an easy department to work in by any means. We must constantly strive to build a strong company that is more efficient and competitive than our rivals.

There are two main pillars of the Toyota Production System that help us achieve this strength.

Show Slide 1 - 11 "TPS Main Principles For Continuous Improvement"

Question: What are the two major pillars of TPS and what do they mean?

1. Just In Time (Right part, right amount, right time)

    -Produce only what is necessary based upon takt time.
    -Create a flexible work site that is capable of responding to changes in demand.

2. Jidoka (Build in quality at the process)

    -Build in high quality at the manufacturing process
    -Separate man from machine

JUST IN TIME

Just in time refers to the elimination of various wastes in production by making only what is needed, when it is needed, in just the right amount.

For example, on an automotive assembly line, thousand of parts are assembled to a vehicle as it moves down a conveyor. If even one part is missing the vehicle is not complete. On the other hand, if parts are delivered too early, then a mountain of inventory is built up at each process. This will lead to various types of problems at the work site, and contribute to wasteful, inefficient motion.

Consequently, at any process we want only the necessary part, at the necessary time, in the necessary amount, or we cannot improve efficiency. One of the primary ways that we accomplish this in TPS is by implementing pull systems, where the following process goes back and picks up parts from the preceding one on a JIT basis.

Takt Time

The products we manufacture involve many processes and require a wide range of materials. The production process, extending from raw materials to the finished product, is both extensive and complicated. It may include casting, machining, painting, plastic molding, and assembly.

Often in production the lead time is often very long or the total number of parts used is in the thousands. Our own manufacturing processes are also extensive and difficult in their own right.

If we all tried to just produce what was most convenient for each of us, then the whole system would break down and many types of waste would occur.

QUESTION: What types of problems would occur if we each just followed our own schedule and ignored others?

Example of answers

-Inventory would increase
-Part shortages would occur
-Shipments would be missed
-Frustrations would arise

To avoid these types of problems we need some type of time standard by which to sequence our internal operations with that of the customer.

We call this time standard “takt time”.

Show Slide 1 - 12 "JIT & Jidoka" (Top Half Only)

1) Set Production Based Upon Takt Time

Production plans are tied closely to forecasts of sales and are also adjusted based upon actual customer releases. Using this data we calculate the pace at which we should manufacture. We should not calculate this pace based upon the capacity of equipment. In order to determine a line's takt time we need to know the amount of production scheduled for a month and the total amount of available time for that production.

Takt time is the time standard by which we produce the "right part, at the right time, in the right amount". Following takt time keeps us from over producing, and is also a very important element for enabling standardization to occur. We will practice this calculation in later sessions.

2) Pull System

In a true pull system, only the pacemaker process understands the production schedule. Based upon what the final process makes, a signal then goes back to preceding processes to replenish just what has been taken away. This facilitates just in time manufacturing. The advantages of this system are that early production, and over production are prevented while actual problems surface very rapidly.

In traditional manufacturing, each stage of the process makes in accordance with its own interests in mind first and then "pushes" what they made forward to the next process. In this type of system, preceding processes manufacture without regard for following processes, and it is very easy to build up large banks of inventory that create waste.

3) Continuous Flow Processing

In order for us to produce just the right part, at the right time, in the right amount, it is best for us not to produce in extremely large batch sizes, but in smaller lot sizes (theoretically 1 piece flow / batch of 1 capability). Making production continually flow is one of the key ways to shorten production lead time, and to eliminate various types of waste from our work sites.

If every production area were to produce in very large lot sizes and hold inventory, then the flow of production would stagnate, and the waste of over production would occur, as well as part shortages. For this reason we strive to set up areas of continuous flow.

This basic way of thinking applies to sites with long manufacturing lines as well as ones with short manufacturing lines. Parts are to be produced ideally one by

one in accordance with what is being taken away from upstream processes. When this is not possible we must then product in small lot sizes or small order quantities in the interim.

Conditions for Success In Just In Time Production

Level Production

In order to produce a large number of different style products efficiently, level production is often the most efficient method. Generally, the more varied our production schedule is, the more waste is created. One of the reasons why is that we often align our equipment to be capable of meeting peak demand capacity. When customer demand declines, we still have a tendency out of habit, to produce with the same amount of equipment and resources, which drives cost up.

In order to reduce the variances in production, it is important for us to level the production schedule out as much as possible. On one line, for example, we may run multiple types of products. In addition to balancing out the total number of units produced, we also try and balance out the mix as well.

This balancing process is what we refer to as level production and is an integral part of the Toyota Production System. Level production allows us to eliminate much of the “waste, overburden, & unevenness” that we often observe in our manufacturing sites. Consequently we are better able to produce a less expensive product and provide other benefits to the company.

Small Lot Production

When we manufacture in large quantities, using various materials at one time in a continuous run, we call this lot production. Producing final goods in this manner is called large lot or “batch” production.

Large batch production is often thought to be an efficient type of production but it also invites many types of other problems. Some processes such as paint, die cast, molding, etc. are inherently batch due to the nature of the process. As much a possible, however, we like to reduce batch sizes and build a work site capable of responding immediately to changes in customer demand. Smaller batch sizes require us to change over more quickly, keep inventory levels lower, and avoid wasting space.

KEY POINT: If necessary explain the types of problems associated with lot production. Prepare examples relevant to your area.

JIDOKA

Show Slide 1 - 12 "JIT & Jidoka" (Bottom Half Only)

In TPS we try to arrange a work area so that when something goes wrong, the equipment itself detects the error or mistake and stops automatically. Also, the area is set up so that it can be stopped by the team member if necessary. In TPS we call this concept "Jidoka" – a Japanese word that means to build in quality. It is a major pillar which supports the Toyota Production System.

QUESTION: What are some examples or advantages of Jidoka?

-When a problem occurs the machine stops automatically
-Prevents tool & equipment damage
-Stops machine and makes the actual problem very clear
-Enables multi process handling i.e. separation of man & machine
-Safer for operation

The goal of Jidoka is to detect when any abnormal condition occurs, shut down the machine and prevent defects from being passed on to the following process. Ideally, in automated areas, equipment should detect when abnormal quality or safety conditions exists and shut down the process. In areas where there are manual systems in place we rely upon detection after the part is made by either post process detection or inspection.

Show Slide 1 - 13 "The Objective Of Jidoka"

One of the primary aims of Jidoka is to build in 100% quality

The next process is our customer so we must never allow defects to get by in the system. For this reason we attempt to attach some degree of "intelligence" or automatic sensor capabilities to a machine so that when bad parts are produced the equipment will automatically stop.

Another aim of Jidoka is to prevent machine damage.

If a problem develops during the machine cycle, the machine should stop and prevent any further damage from happening. This helps in terms of letting us separate man from machine.

Another aim of Jidoka is labor savings by enabling multi process handling For example If there is a problem in material or the equipment, the process will shut down by itself. Thus, for automated equipment, it is possible to separate the operator from having to monitor the machine full time.

It is not necessarily true that Jidoka only works in machine intensive areas. Assembly lines also must function to allow the operator to shut down the line whenever they detect a problem.

Application of Jidoka on automated machines

It is necessary to devise creative ways of doing Jidoka on automated machines. If you look closely at automatic equipment, there is quite often waste associated with the process. No matter how good the equipment, or how standardized the method, it is not always possible to completely prevent scrap and rework.

When scrap or rework occurs, it is of course important to think about countermeasures to deal with the problem. Countermeasures for defects include temporary fixes and permanent ones.

When only a temporary fix is put in place, the probability that a scrap causing problem will reoccur is very high. Hence the need for true recurrence preventing countermeasures is very important. In order to get true recurrence prevention, it is necessary to investigate problems from every angle and take appropriate action.

When searching for root causes it is important to ask the "5 Why's" and determine the root cause of a problem.

- Write on the board if necessary. Show that stopping at the 1st Why doesn't solve the problem. Only by getting to the 5th Why determines the root cause and prevents the problem from recurring.

Initial Event		
Machine Fault Generated.	1st Why	Blown Fuse
	2nd Why	Bearings Worn
	3rd Why	Insufficient Lubrication
	4th Why	Pump Shaft Worn
Root Cause	5th Why	No Strainer On Inlet Port And Metal Shavings Were Entering Pump Causing Shaft To Wear Out
Solution: Add Strainer		

Standardized Work

On the shop floor manufacturing consists of the 4M's; Man, Machine, Material, and Method. These four items constantly interact to enable us to produce our products.

On the ever changing shop floor it is constantly necessary for the leaders to grasp the actual state of affairs and standardize operations.

Standardized work is the tool we use to create the most effective method of production by combining manpower with machines. Standardized Work is an important basis for the standard of our operations. It is also an important tool for effective cost reduction activities. In Sessions 2 – 5 we will dive deeply into the exact meaning of this topic.

Flexible Manpower Lines

A chief aim of a lean manufacturing system is to produce more efficiently. Combining tools such as Jidoka and Standardized Work will allow us to produce more efficiently with respect to changes in production volume. Ideally we need to be able to flexibly move resources around on a timely basis to reflect increases and decreases in customer demand. This concept is often referred to as Flexible Manpower Lines.

Next I will discuss the application of Flexible Manpower Lines with respect to cost reduction.

Show Slide 1 - 14 "Efficient Resource Allocation" and explain:

-Flexible Manpower Lines & Efficient Resource Allocation

When there are changes in the production volume and we are unable to consolidate work, this is called a fixed manpower line.

Fixed manpower lines are very effective when there are no changes in production demand, but they become a major source of cost when there are changes in production (particularly decreases).

As production leaders we are always trying to achieve manpower savings. For this reason we conduct continuous improvement. Often it becomes necessary for us to change the layout of an area, making it easier to combine tasks, and on the human side to provide training that enables multi process handling to take place.

The key point of the slide is that as actual production volumes change, we must have the capability to flexibly adapt to these changes as well.

VI. Summary

This concludes the first session of our course. We have introduced the main concepts of TPS and set the basis for exploring standardized work over the next few days. Let's briefly review some of the topics we have covered today:

1) Role of a Leader in TPS
2) Manufacturing & Cost Structure
3) Importance of Cost Reduction in TPS
4) Two Pillars of the Toyota Production System

Ask if there are any questions about the material we covered today.

Thank you for your attendance and participation. This concludes session 1 a basic introduction to the main principles of the Toyota Production System.
Tomorrow we will cover session 2 and dive more deeply into the specific topic of Standardized Work and its central role in aiding the concepts of TPS.