Time Is Important

- Most workers are paid for their time on the job.
- The labor content (cost of labor time) is often a major factor in the total cost of a product or service.
- For any organization, it is important to know how much time will be required to accomplish a given amount of work.
Some Definitions

- **Work measurement** – evaluation of a task in terms of the time that should be allowed by an average worker to perform the task.
- **Standard time** – amount of time that should be allowed for an average worker to process one work unit using the standard method and working at normal pace.
- **Time study** – all the ways in which time is analyzed in work situations.
When Are Time Standards Beneficial?

- Characteristics of industrial situations in which time standards would be beneficial
  - Low productivity
  - Repeat orders
  - Long production runs
  - Repetitive work cycles
  - Short cycle times
Functions of Time Standards

- They define a “fair day’s work”
- They provide a means to convert workload into staffing and equipment needs
- They allow alternative methods to be compared objectively
- They provide a basis for wage incentives and evaluation of worker performance
- They provide time data for:
  - Production planning and scheduling
  - Cost estimating
  - Material requirements planning
Functions of Time Standards

- They used to develop answers for the following problems:
  - Determining the number of machine tools to buy
  - Determining the number of people to employ
  - Scheduling the machines, operations, and people to do jobs and deliver on time with less inventory
  - Determining the assembly line balance
  - Determining individual worker performance
  - Paying incentive wages for outstanding performance
  - Developing operation personnel budgets to measure management performance
Functions of Time Standards

Figure 4-1: Operations chart for a water valve factory. A circle for every fabrication, assembly, and packout operation.
Methods to Determine Time Standards

- Estimation
  - Estimated times
- Historical records
  - Historical times
- Work measurement techniques
  - Direct time study
    - Engineered standards
  - Predetermined motion time systems
  - Standard data systems
  - Proportions of work activities
  - Work sampling
Work Measurement Techniques

- Direct time study (DTS)
- Predetermined motion time system (PMTS)
  - Performance rating is not required
  - Can be applied to determine the time standard for a task before production
- Standard data systems (SDS)
- Work sampling
Task Hierarchy & Work Measurement

<table>
<thead>
<tr>
<th>Task Hierarchy Level</th>
<th>Work Measurement Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job level</td>
<td>Work sampling</td>
</tr>
<tr>
<td>Task level</td>
<td>Direct time study, standard data systems</td>
</tr>
<tr>
<td>Work element level</td>
<td>Predetermined motion time systems</td>
</tr>
<tr>
<td>Basic motion element level</td>
<td></td>
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</tbody>
</table>
Prerequisites for Valid Time Standards

Factors that must be standardized before a time standard can be set
Average Worker

A worker who is representative of the persons who usually perform tasks similar to the task being measured

- If the work is performed mostly by men, then the average worker is male
- If the work is performed mostly by women, then the average worker is female
Standard Performance

A pace of working that can be maintained by an average worker throughout an entire work shift without harmful effects on the worker’s health or physical well-being

- The work shift includes periodic rest breaks and occasional interruptions are experienced by the worker
- Benchmarks of standard performance:
  - Walking at 3 miles/hr on level flat ground
  - Dealing four hands of cards from a 52 card deck in exactly 30 sec
Standard Method

- Must include all of the details on how the task is performed, including:
  - Procedure - hand and body motions
  - Tools
  - Equipment
  - Workplace layout
  - Irregular work
  - Working conditions
  - Setup
Standard Work Units

- The time needed to process the work unit depends on its starting condition
  - Therefore this condition must be specified
  - If the actual condition deviates from the specification, then extra time may be required to accomplish the task
- Exactly what changes are made in the work unit by the task?
- What is the final state of the completed work unit?
Allowances in Time Standards

- Normal time is adjusted by an allowance factor $A_{pfd}$ to obtain the standard time.
- Purpose of allowance factor is to compensate for lost time due to work interruptions and other reasons.
- Standard time:
  \[ T_{std} = T_n (1 + A_{pfd}) \]
  where pfd = personal time, fatigue, and delays.
### Reasons for Lost Time at Work

<table>
<thead>
<tr>
<th>Work-related interruptions</th>
<th>Non-work-related interruptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Machine breakdowns</td>
<td>• Personal needs (e.g., restroom breaks)</td>
</tr>
<tr>
<td>• Waiting for materials or parts</td>
<td>• Talking to co-workers about matters unrelated to work</td>
</tr>
<tr>
<td>• Receiving instructions from foreman</td>
<td>• Lunch break</td>
</tr>
<tr>
<td>• Talking to co-workers about work-related matters</td>
<td>• Smoke break</td>
</tr>
<tr>
<td>• Rest breaks for fatigue</td>
<td>• Beverage break</td>
</tr>
<tr>
<td>• Cleaning up at end of shift</td>
<td>• Personal telephone call</td>
</tr>
</tbody>
</table>