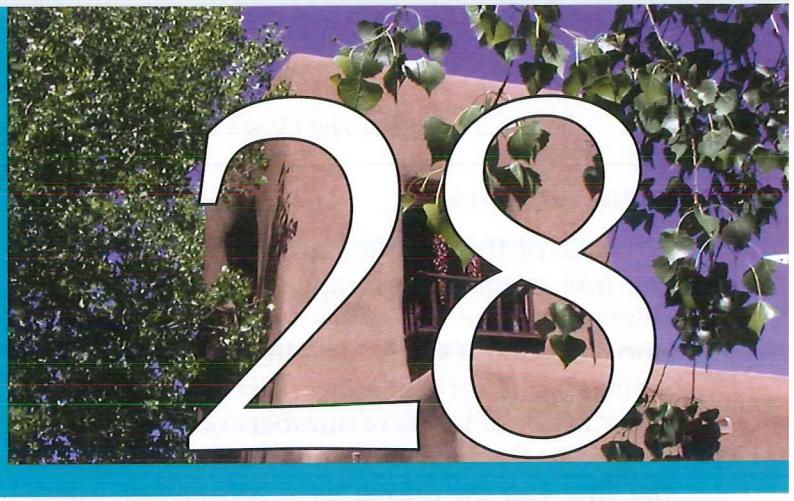
Graphs and Charts



Learning Objectives

After studying this chapter, you will be able to:

- List and describe the types of graphs and charts prepared by drafters.
- Explain how graphs and charts are developed.
- Identify common applications for constructing graphs and charts.

Technical Terms

Bar graph
Chart
Deviation bar graph
Flow chart
Graph
Grouped bar graph
Horizontal bar graph
Index bar graph
Line graph
Line personnel
Nomograph
Organizational chart
Paired bar graph
Percentage bar graph
Pie graph
Range bar graph
Staff personnel
Subdivided bar graph
Surface graph
Vertical bar graph

Drafting departments are called on from time to time to prepare graphs and charts. These are visual devices that provide an excellent means of presenting data in graphic form. Graphs and charts are used for contract proposals, analysis, and marketing. As one familiar with drafting procedures, you possess many of the skills for this work.

A ***graph*** is a diagram that shows the relationships between two or more factors. A ***chart*** may be defined as a means of presenting information in tabulated or graphic form.

Types of Graphs and Charts

Many forms of graphs and charts are used to analyze and clarify data. The major types are presented in the following sections.

Line Graphs

One of the simplest graphs to construct is the ***line graph***. Line graphs are used to show relationships of quantities to a time span. The horizontal axis (X axis) usually contains the time element. The vertical axis (Y axis) expresses the other factor in terms of numbers or percentages.

After the data is plotted in the line graph, the line can be drawn as a broken-line curve from point to point, **Figure 28-1**. The line can also be a smooth curve, **Figure 28-2**. When it is desirable to show an actual condition or status for each of the time periods, use the broken-line curve. However, when the change is continuous, a smooth curve approximating the actual data for each time interval is more meaningful.

Symbols at each of the data points or variations in the form of the line itself are sometimes used to represent differences in factors or methods of treatment, **Figure 28-3**. A line graph may also be used to compare design factors of a material, **Figure 28-4**.

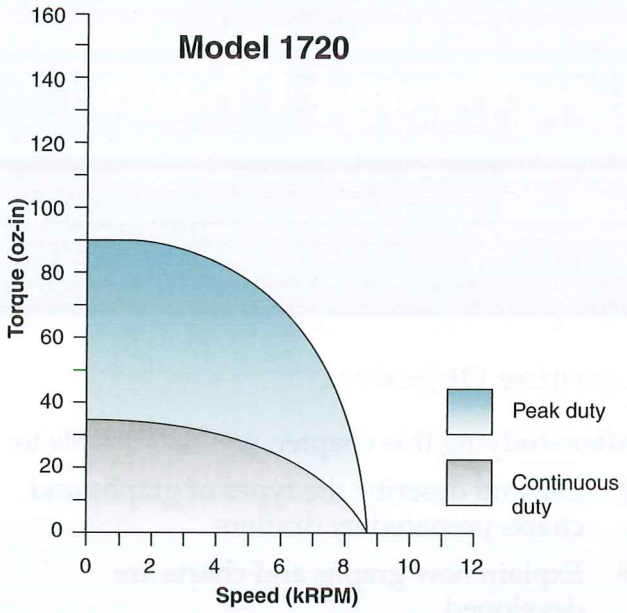


Figure 28-2. A line graph showing output data for a servo motor. The smooth curve is used to reflect a continuous change, rather than a sharp change for each interval. Data is gathered for each interval and plotted. The curve approximates the plotted points. (Animatics Corp.)

Figure 28-1. A line graph can be used to show the relationships of quantities or percentages over a period of time.

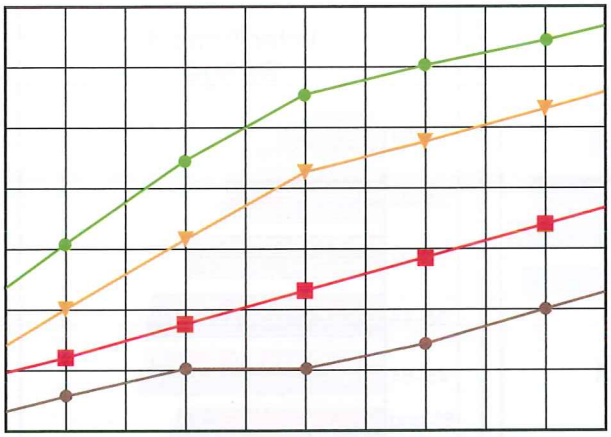


Figure 28-3. When several curves are to be plotted on the same line graph, symbols can be used to differentiate each item. Color can also be used, alone or in combination with symbols, to set the curves apart.

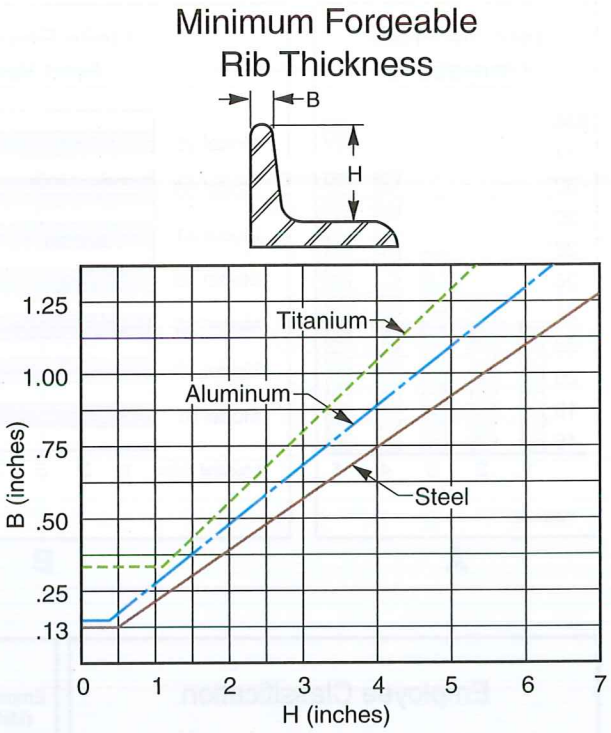


Figure 28-4. Line graphs can be used to compare dimensional features of different metal stocks.

Bar Graphs

A ***bar graph*** is used to show relationships between two or more variables. However, bar graphs have fewer plotted values for each variable than a line graph. Bar graphs are a popular form of presenting statistical data, because they are easily understood by laypersons.

The data presented in a bar graph is usually for a total period of time rather than for various periods, such as those in a line graph. For example, a bar graph may show production per hour, day, or year, but usually not successive periods of production.

There are two basic types of bar graphs: *index bar* and *range bar*. An ***index bar graph*** has a common base where the bars originate, **Figure 28-5**. A number of variations are possible with index bar graphs. A ***range bar graph*** has individual bars, representing segments of the whole, that are plotted within the range of the total period, **Figure 28-6**.

The ***vertical bar graph*** and ***horizontal bar graph*** are the most common types of index bar graphs. Refer to **Figure 28-5A** and **Figure 28-5B**. However, the ***grouped bar graph*** permits the inclusion of other variables in an effective manner. Refer to **Figure 28-5C**. When the grouped bar method is used, an identical sequence of elements should be maintained, and each element should be distinctively shaded or colored.

The ***subdivided bar graph*** is effective when there are fewer than five divisions. The graph loses its value when too many divisions make it difficult to appraise the relative value of each. When the subdivided bar graph is used, the most important or sizable element should be plotted first (next to the index line). Follow this with the item that is next in importance, and so on until the graph is completed. The same order of elements should be retained when two or more subdivided bars are used, regardless of the variation in importance or size in successive bars.

The ***percentage bar graph*** is a type of subdivided bar graph. It is particularly easy to

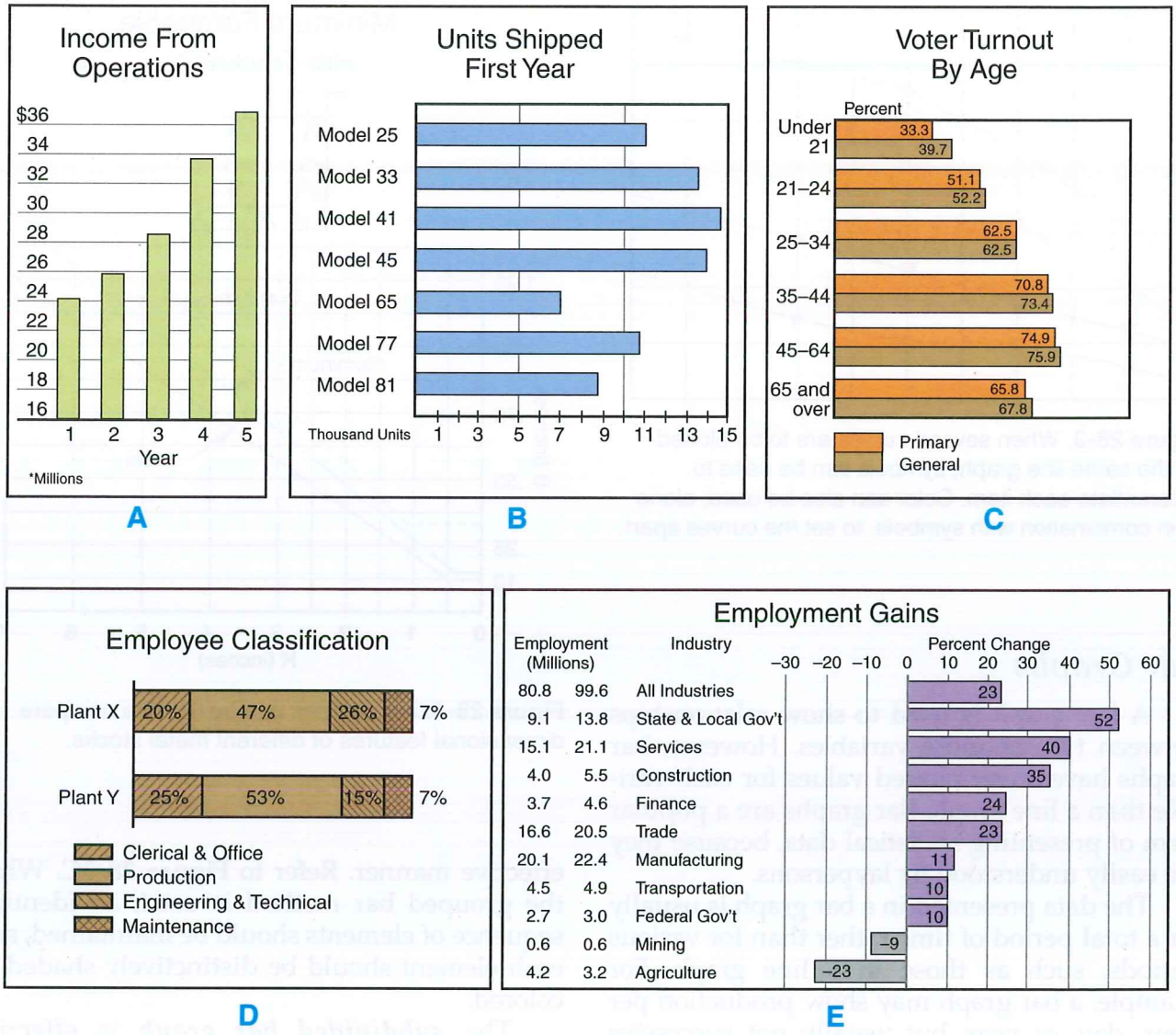


Figure 28-5. There are several variations that can be used in preparing index bar graphs. A—Vertical bar graph. B—Horizontal bar graph. C—Grouped bar graph. D—Subdivided bar graph. E—Deviation bar graph.

read when the percentages are included. Refer to **Figure 28-5D**.

The ***paired bar graph*** is useful when comparing two sets of factors on different scales. A typical use is to show the total value of raw products purchased, as contrasted with the percentage of this amount purchased from a single supplier.

The ***deviation bar graph*** provides a comparison between a number of factors and their deviation from a "break-even" point. Refer to **Figure 28-5E**. This type of graph lends itself well to such comparisons as profit and loss or increase and decrease. On a horizontal deviation bar graph, the bars are drawn from a zero index line with positive values running to the right and negative values to the left. On a vertical deviation bar graph, positive values should appear above the index line and negative values below.

The range bar graph normally plots the items against a time line. A typical example would be to plot a production schedule in which each phase would be plotted as a time range within the time schedule shown for the entire project. Refer to **Figure 28-6**. The range bar graph may also be used to show progress.

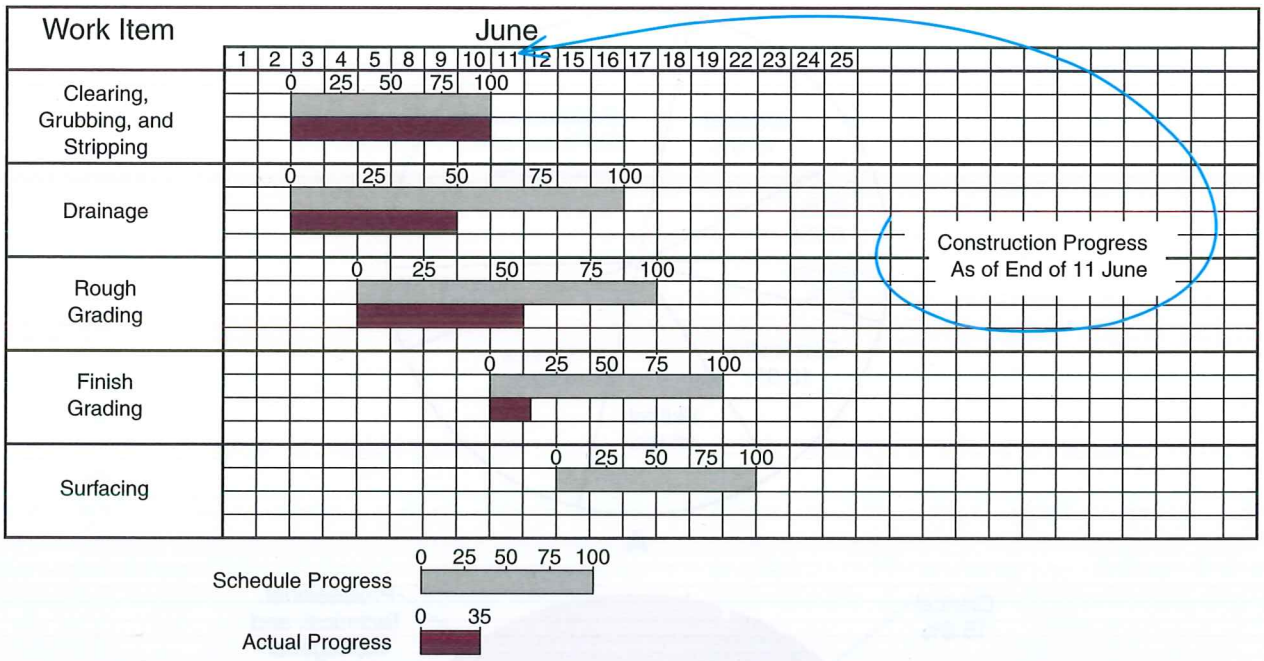


Figure 28-6. A range bar graph can be used to compare the scheduled progress and actual progress on a construction project.

Surface Graphs

A ***surface graph*** or *area graph* is an adaptation of the line or bar graph. The areas between curves are shaded for emphasis, **Figure 28-7.**

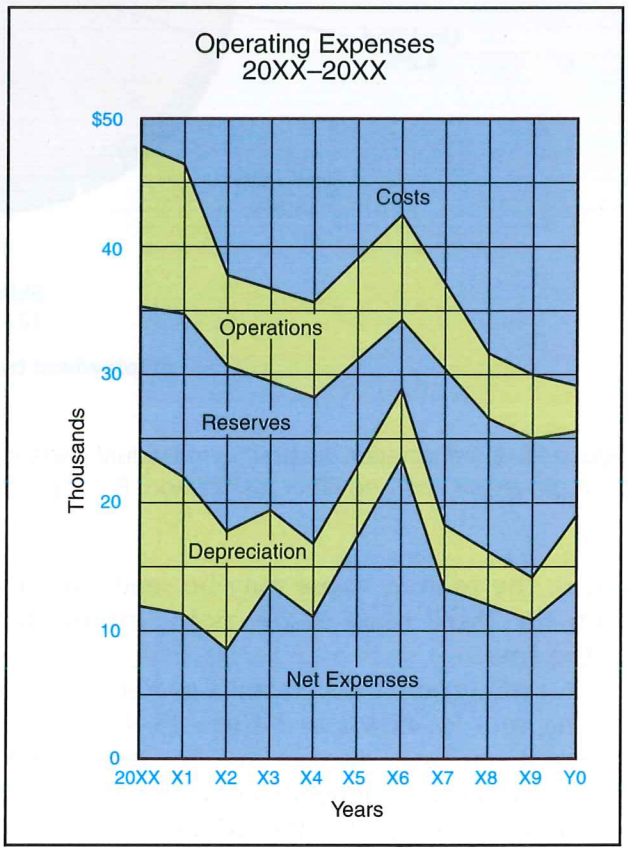


Figure 28-7. A surface graph.

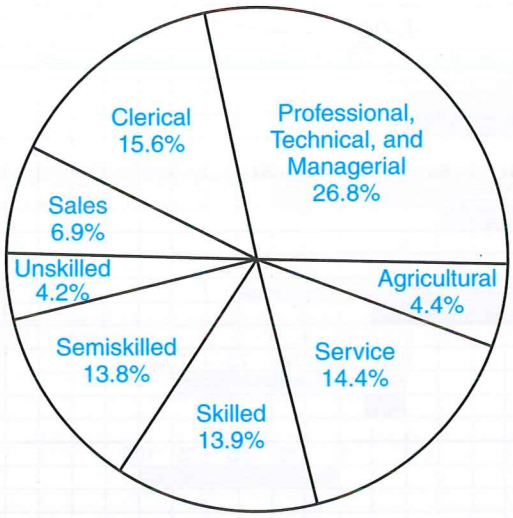
Pie Graphs

A ***pie graph,*** sometimes called a *circle graph* or *sector graph,* is frequently used to contrast individual segments (parts) with the whole. A typical example of this is the graph shown in **Figure 28-8A**. This graph depicts the distribution of the labor force in one area. The pie graph can be varied by drawing it as a pictorial, **Figure 28-8B**.

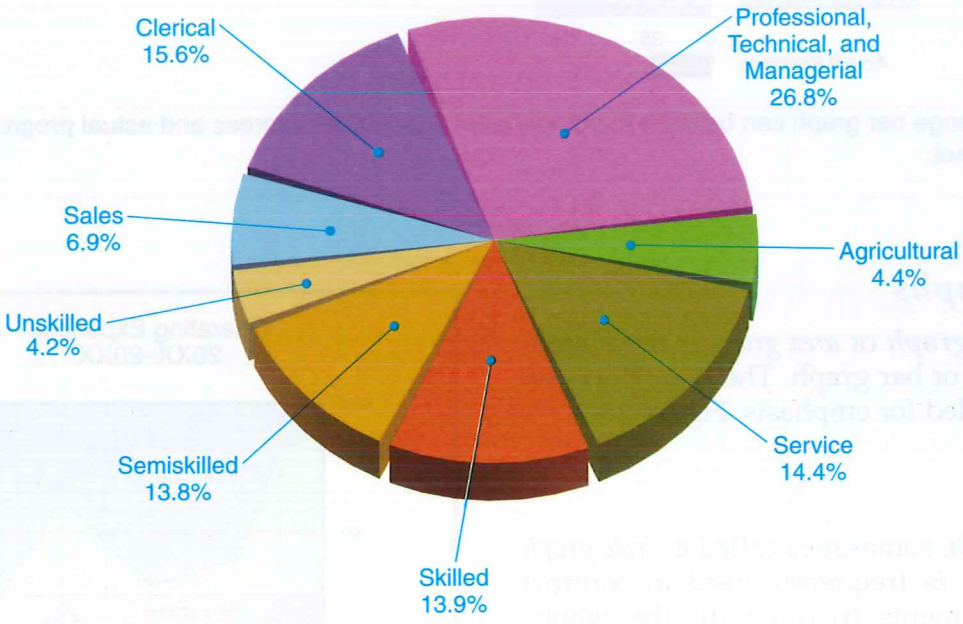
Pie graphs can also be used to represent cost expenditures. Each segment should be accurately drawn in relation to the portion it represents.

Nomographs

A ***nomograph*** is useful in solving a succession of nearly identical problems. This graph usually contains three parallel scales that are graduated for different variables. When a straight line connects values of any two



A



B

Figure 28-8. Information illustrating individual parts in relation to a whole can be presented with a pie graph. A—A pie graph showing labor distribution. B—A pictorial pie graph is a variation of a pie graph.

scales, the related value may be read directly from the third scale at the point intersected by the line.

A nomograph created for a specific carbide cutting tool is shown in **Figure 28-9**. It allows different cutting speeds to be determined quickly and easily depending on factors of feed, depth of cut, and material hardness.

Flow Charts

A ***flow chart*** is a graphic means of depicting a sequence of technical processes that would be difficult to describe in narrative form, **Figure 28-10**. The flow of various processes and materials in manufacturing and production can be clearly detailed in a flow chart. Pictures, symbols, and diagrams should be used when they aid in understanding.

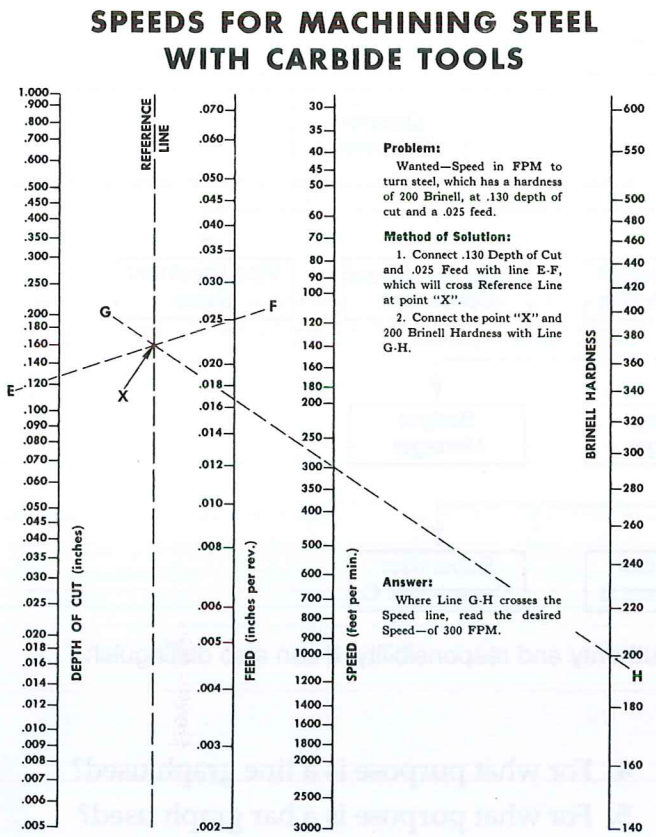


Figure 28-9. Nomographs can be used to make quick determinations within given parameters, such as cutting feed data and other given machining data. (Seco Tools, Inc.)

Organizational Charts

An ***organizational chart*** does for personnel what a flow chart does for processes and materials. It shows relationships between individuals and departments within an organization and the operations or services each performs, **Figure 28-11.**

The organizational chart also shows the relationship between line personnel and staff personnel within an organization. ***Line personnel,*** such as supervisors and department heads, have authority to direct an operation or a group. Lines in the chart clearly show this authority.

Staff personnel, such as consultants for numerical control machines, may suggest and recommend procedures and types of equipment to the manufacturing manager. However, they cannot direct that the suggestions or recommendations be carried out. The organizational chart indicates these responsibilities.

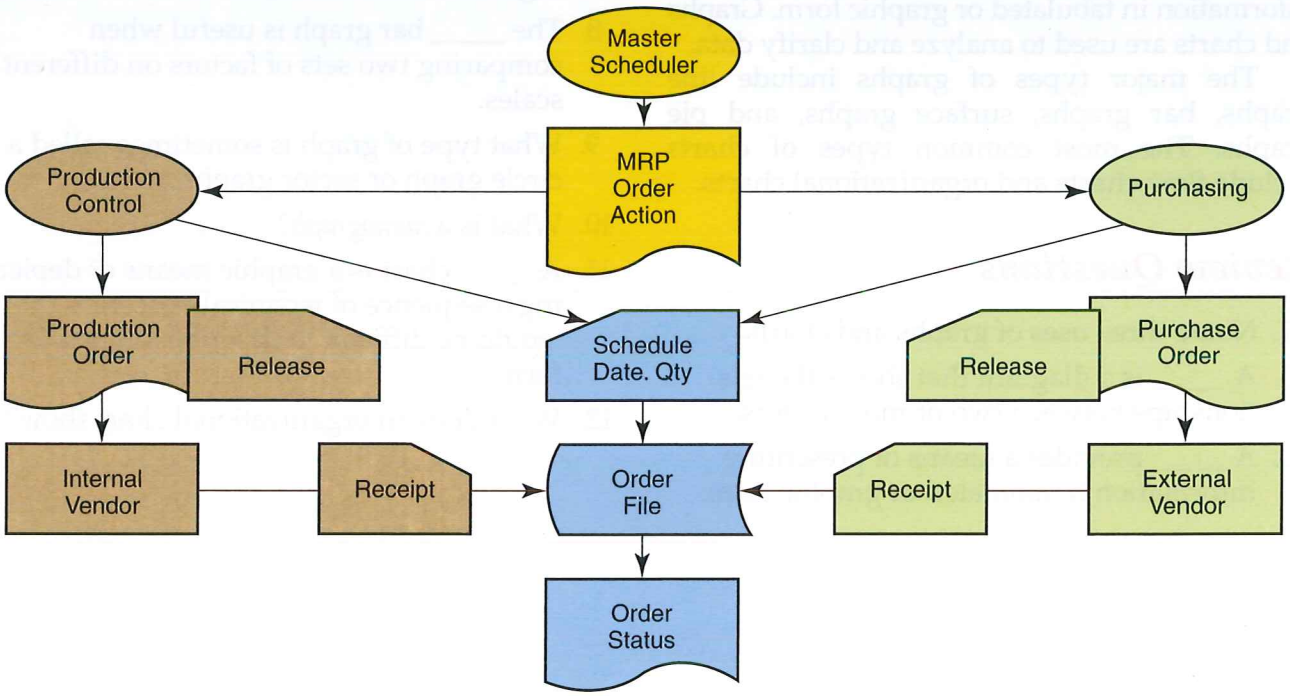


Figure 28-10. Flow charts can be used to show how material flows into the manufacturing process through the purchasing and production control functions.

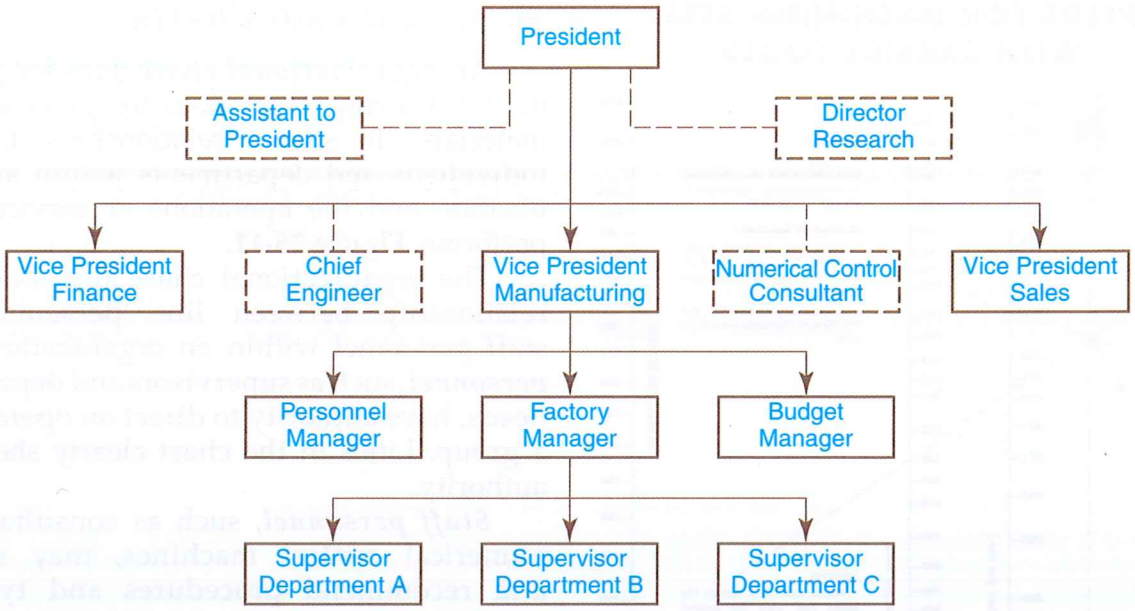


Figure 28-11. An organizational chart shows the lines of authority and responsibility. It can also distinguish between those who serve in staff and support positions.

Chapter Summary

Drafting departments are called on from time to time to prepare graphs and charts for informational presentations. Graphs are diagrams that show relationships between two or more factors. Charts may be defined as a means of presenting information in tabulated or graphic form. Graphs and charts are used to analyze and clarify data.

The major types of graphs include line graphs, bar graphs, surface graphs, and pie graphs. The most common types of charts include flow charts and organizational charts.

Review Questions

1. Name three uses of graphs and charts.
2. A _____ is a diagram that shows the relationships between two or more factors.
3. A _____ provides a means of presenting information in tabulated or graphic form.
4. For what purpose is a line graph used?
5. For what purpose is a bar graph used?
6. What are the two basic types of bar graphs?
7. The _____ bar graph is effective when there are fewer than five divisions representing segments of the whole.
8. The _____ bar graph is useful when comparing two sets of factors on different scales.
9. What type of graph is sometimes called a circle graph or sector graph?
10. What is a *nomograph*?
11. A _____ chart is a graphic means of depicting a sequence of technical processes that would be difficult to describe in narrative form.
12. What does an organizational chart show?

Problems and Activities

The following problems are designed to provide you with an opportunity to apply the skills used in constructing graphs and charts. The problems can be drawn manually or with a CAD system. Complete each problem as assigned by your instructor.

1. Collect data on a subject of interest to you and use the information to construct a line graph. Magazines in your school, public, or drafting library are good sources of data.
2. Collect data on a subject of interest to you and prepare a bar graph.
3. Construct a surface graph illustrating traffic safety and accident statistics. Gather data from driver training classes, safety classes, or an insurance company.
4. Gather budget information from an annual report. Use a local or state government report, or request a report from a private organization or business. Use the data to prepare a pie graph to graphically contrast the budgeted dollars.
5. Construct a flow chart illustrating the sequence followed in an industrial process, such as anodizing aluminum, making an electronic circuit board, or preparing and spray painting a metal surface.
6. Gather information from your city government and prepare an organizational chart showing line and staff organization.