

# INDUSTRIAL DATA PROCESSING APPLICATIONS REPORT

**Applications** Inventory Control, Order Processing (partial),  
Sales Forecasting, Machine Load for Parts  
Fabrication, Payroll

**Type of Industry** Manufacturer of Bodies for Commercial and  
Government Buses and Other Vehicles,  
Truck Cabs and Components

**Name of User** Superior Coach Corp.  
Lima, Ohio

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**Equipment Used** Honeywell 200 Computer System

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## Synopsis

Due to options, either desired by customers or required by state laws, hundreds of variations are found on the 8,000 school bus and 2,000 hearse and ambulance orders received each year by Superior Coach Corp. With inventory being controlled manually, there were constant shortages of some stock items while inventory levels on others often stood at two or three times the annual requirements. With virtually all inventory data now on magnetic tape files, Superior is able to update inventory items automatically and to pinpoint potential shortages before they occur. Utilizing these files with data input during order processing, the company is able to produce a bill of material and assembly parts list used on the production line. Other programs use this data along with historical information on sales and sales projections to arrive at yearly forecasts of parts and material requirements. When parts are to be built in house, a program generates the necessary work orders and other documentation, including work assignment cards that serve as input to the payroll processing run.

## BACKGROUND

Superior's prime reason for implementing a computer system was the problem of inventory control. With school buses alone, there are 90 different makes and models of chassis on which school bus bodies can be mounted; seats of various types and sizes are available; different types of doors and stepwells may be ordered; state requirements differ; and hundreds of accessories, ranging from special lights to raised wood floors over zinc-coated underbodies, may be designated by the customer. As the system to control inventory in such a way to account for all these variables was being planned and implemented, other phases of a "total system" also were taken into consideration. Some of these phases are now operational, others still are in the planning stage.

The Superior Coach Corp. was founded in 1926 and is today the leading manufacturer of school buses, ambulances and funeral cars. Superior employs some 2,100 persons at three plants located in Lima, Ohio, Kosciusko, Miss. and Norwalk, Ohio.

The Lima plant also is the company's headquarters.

The company began manufacturing steel school buses in 1931 and established an independent franchised dealer organization to distribute the product. The dealer group was expanded in 1936 when the firm began manufacturing other vehicle bodies.

Domestic sales of buses account for approximately 40 percent of Superior's business with 40 percent from manufacture of other commercial vehicles and 20 percent from production of special vehicle bodies for government agencies. Sales range in the neighborhood of \$57 million annually.

## INVENTORY CONTROL

Superior reflects all inventory action on a magnetic tape master parts and assembly file which is updated six or seven times weekly. In all, 28 different items are contained in the file: part number, part name, unit of measure code, origin code (indicating type of item--fabricated, purchased, raw material, etc.), planner code (the individual in production planning responsible for inventory of the item), entry date (when the item was released for use), date of cancellation, estimated annual usage, material cost per unit, labor cost per unit, store room location, re-order point, economic order quantity, lead time (in weeks), service department usage (year to date), scrappage (year to date), date of last action on each item, quantity made (or received) year to date, store room balance, cycle inventory adjustments, date of last inventory, balance on hand, production line usage (year to date), production line requirements for next week's schedule, production line requirements for the next four weeks' schedule, total quantity on open orders and quantity due within 30 days, codes indicating product line, or lines, on which each item is used.

### Order Entry

Sales orders are received by mail from distributor-dealers. These are edited in the sales distribution department where Superior's order number and the distributor-dealers' code numbers are added. After sales distribution determines that the orders are complete and accurate, they are sent to the data processing department for keypunching. Each item on each order is punched into a tab card along with Superior's order number. The cards for each order are then combined into order decks.

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As order decks are run through the computer, data is entered on the magnetic tape orders-in-house file. Copies of the order are printed out for acknowledgment to the distributor-dealers and for all shop and office functions.

SALES ORDER INPUT

Form 98 Rev. 1-63 400 bks. **SCHOOL AND PASSENGER COACH PURCHASE ORDER**

INSTRUCTIONS: Prepare 4 copies, Original and Duplicate to Superior, Distributor retains 3rd and 4th to customer. Attach Tax Exemption Certificate if necessary. Acknowledgment of order will be sent to distributor on separate form.

**SUPERIOR COACH CORPORATION**  **LIMA, OHIO AND KOSCIUSKO, MISSISSIPPI**

Del. Will Inst. Advise State Specs. 30 Date 2-6-68 Quantity one Superior's Order No. 68-1098-1547

CODE # 589

Distributor Superior Sales of Wiseton City Wiseton State Any Order No. 68-114

School or Owner Sharp School District County Happy City Wiseton State Any

Chassis Dealer Will Advise Street City State

| MODEL <u>68-1098</u> |                                                 | LENGTH <u>9 sect., 18 in. ext.</u> |                              | SIDE WINDOWS <u>Split/19726</u> |                              |
|----------------------|-------------------------------------------------|------------------------------------|------------------------------|---------------------------------|------------------------------|
| S. E. NO.            | ITEM                                            | S. E. NO.                          | ITEM                         | S. E. NO.                       | ITEM                         |
| <u>12285</u>         | Cover, Lower Door Control                       | 1525                               | Floor, Wood                  | 10100                           | Stepwell 18 3/4"             |
| <u>12285</u>         | Door, Entrance                                  | 11640                              | Underbody Super Zinc Kote    |                                 | Steptread, Ent. Door, Rubber |
|                      | Door, Emergency                                 |                                    | Rub Rail, Lower, around Rear |                                 | Special Body                 |
|                      | Front End Wraparound W/S                        |                                    | " " , Snow                   |                                 | Vent, Front Roof Exhaust     |
| <u>1650</u>          | Insulation (Complete) <u>CEPO</u> Complete Body |                                    | Sash, Driver's, W/Vent       |                                 | Window, Ctr. RR Emg. Door    |
|                      | "School Bus" - front                            | 12004                              | " " , Pushout                | 12025                           | Laminated glass              |
|                      | "School Bus" - rear                             |                                    |                              |                                 |                              |

ROWS 10 SIZE 39" SPACE maximum COLOR green MATERIAL fiberglass

TYPE school bus - 12136 - 39", single pedestal (2 leg)

| SEAT | DESCRIPTION                 | QTY | SEAT | DESCRIPTION                              | QTY                       |
|------|-----------------------------|-----|------|------------------------------------------|---------------------------|
|      | Davenport (27/42/52-oz.)    |     | 1270 | Pads, Back, Cushion, Fire Res., Driver's |                           |
|      | Driver's Seat (42/52-oz.)   |     |      | " " " " " , Dav.                         | 812147                    |
|      | 12136 R.H. single ped. - 10 |     |      | " " " " " , 39" Seats                    |                           |
|      |                             |     |      |                                          | Stainless Steel Top Rails |

Seller shall not be responsible or liable for any delays or failures in delivery due to causes beyond its control such as, but not limited to, strikes, differences with workmen, scarcity of labor, fires, floods, storms, accidents, breakage of machinery, scarcity of materials or fuel, transportation embargoes, scarcity of cars, governmental regulations or orders, perils to navigation, acts of public enemies or Acts of God.

TYPICAL SALES ORDER RECEIVED BY SUPERIOR FROM ONE OF ITS DISTRIBUTOR-DEALERS. MANUALLY WRITTEN AND UNDERSCORED ITEMS REPRESENT ACTION TAKEN IN THE SALES DISTRIBUTION DEPARTMENT PRIOR TO KEYPUNCHING.

ORDER RELEASE--OUTPUT

**SUPERIOR COACH CORPORATION - LIMA, OHIO**

589 SUPERIOR SALES OF WISETON WISETON, ANY, 99999

ORDER NO. 68-1098-1547

EXHIBIT B.

MODEL YR. 68 MODEL NO. 1098 BODY NO. 1547

DELV. DRIVEAWAY STATE 30 MODEL 68-1098 WIND SPLIT/19726

B 12025 GLASS, LAMINATED, SPLIT S/WELL 18 3/4 - 10100

D 1525 FLOOR, WOOD

Y 12285 TUBULAR TYPE ENTR. DOOR

T 1650 INSULATION, COMPLETE BODY

11640 ZINC-COAT UNDERBODY

ROWS 10 SIZE 39" SPACE MAXIMUM

COLOR 12136 SEAT, FIBERGLASS RH - 10

TYPE 12137 SEAT, FIBERGLASS LH - 10

E 812147 DRIVERS SEAT, FLAT BACK - 52 OZ. TRIM MATERIAL

A 1270 CRASH PAD, FIRE RESISTANT, DRIVERS SEAT

T CEPO 15172, S.E. 1572 - CRASH PADS FOR FIBERGLASS SEATS - 18

MOD. 17737

1150 REAR TOW HOOK

1596 FRONT FENDER FLAPS - 1598 REAR FENDER FLAPS

15173 100 AMP AMMETER IF NOT ON CHASSIS

11178 BATTERY DISCONNECT SWITCH

11178 BATTERY DISCONNECT SWITCH

11178 BATTERY DISCONNECT SWITCH

TWELVE COPIES OF THE ORDER RELEASE ARE PRINTED OUT AFTER ENTRY OF SALES ORDER DATA ON PUNCHED CARDS, IN ORDER TO GET THAT MANY COPIES IN ONE COMPUTER RUN, SUPERIOR USES SIX-PART FORMS, WITH THE RIGHT HALF OF THE FORM BEING A DUPLICATE OF THE LEFT HALF.

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One of the copies of the order release goes to a foreman in the shop where it is used, along with the bill of materials, in assembling the unit. Other copies go to distributor-dealers and to various other in-house departments, such as cost accounting.

**ORDERS-IN-HOUSE FILE**

The magnetic tape orders-in-house file is maintained in a sequence based on: product line (bus, ambulance, etc.), type of item on the order (standard body, standard extra or variant), model number within the product line, individual standard extra or variant number, status of the order (a numeric code to indicate one of the following: not yet scheduled for production, tentatively scheduled to be built in the four-week period that follows next week's schedule date, scheduled to be built next week, already built or being built this week).

Orders remain unscheduled until they are included on an informal list issued weekly by sales distribution. The list identifies the units tentatively scheduled for production during the "fifth week from now." Data from the order status listings is used to arrive at a firm production schedule for the "next week." This firm schedule is produced by the production planning department. A unit is reclassified as being built when it is shown on the foreman's daily "framing report" as being started.

**PRODUCTION SCHEDULE**

EXHIBIT C.

**CONVENTIONAL SCHOOL BUS FRAMING SCHEDULE**

Form No. 807 Rev. 7-64 DATE 1-29-68  
 WEEK OF 2-5-68 LINE NO. SCHEDULE NO. 10-2

| SILL NO.        | BODY NO. | STATE SPEC. | BODY SIZE | CHASSIS |        | BATTERY RES. | C TO A DIM | W/H LOC. | S.W. DEPTH | FLOOR | DOORS TYPE-CONTROL |         | FRONT END | W/2 WIPERS | REAR END | SIGN COX |      | SASH | COLOR OF PAINT | SPEC. SEATS | MISC. - CEPO, STD. EXTRA |
|-----------------|----------|-------------|-----------|---------|--------|--------------|------------|----------|------------|-------|--------------------|---------|-----------|------------|----------|----------|------|------|----------------|-------------|--------------------------|
|                 |          |             |           | MAKE    | NO.    |              |            |          |            |       | ENT.               | EMER.   |           |            |          | FRT.     | REAR |      |                |             |                          |
| 496             | 3228     | minn        | 98        | W       | 125687 | 12245        | 211 1/2    | 2 1/2    | 20 3/4     | W     | Tube               |         | W         | ✓          | 11940    |          |      | S    | Orange         |             | 11938                    |
| 497             | 2946     | So Dak      | 109       | Dyc     | 031992 |              | 230 1/2    | 2 1/2    | 22 3/4     | S     | Press              | Control | F         | ✓          | 11943    |          |      |      | MSBC           | 10 1/2      | 11939                    |
| WASHINGTON BODY |          |             |           |         |        |              |            |          |            |       | WASHINGTON BODY    |         |           |            |          |          |      |      |                |             |                          |

A FIRM SCHEDULE FOR THE "NEXT WEEK" IS DRAWN UP BY THE PRODUCTION PLANNING DEPARTMENT BASED ON INFORMATION RECEIVED FROM SALES DISTRIBUTION AND FROM THE ORDER STATUS FILE.

**FOREMAN'S FRAMING REPORT**

EXHIBIT D.

**SUPERIOR COACH CORPORATION**

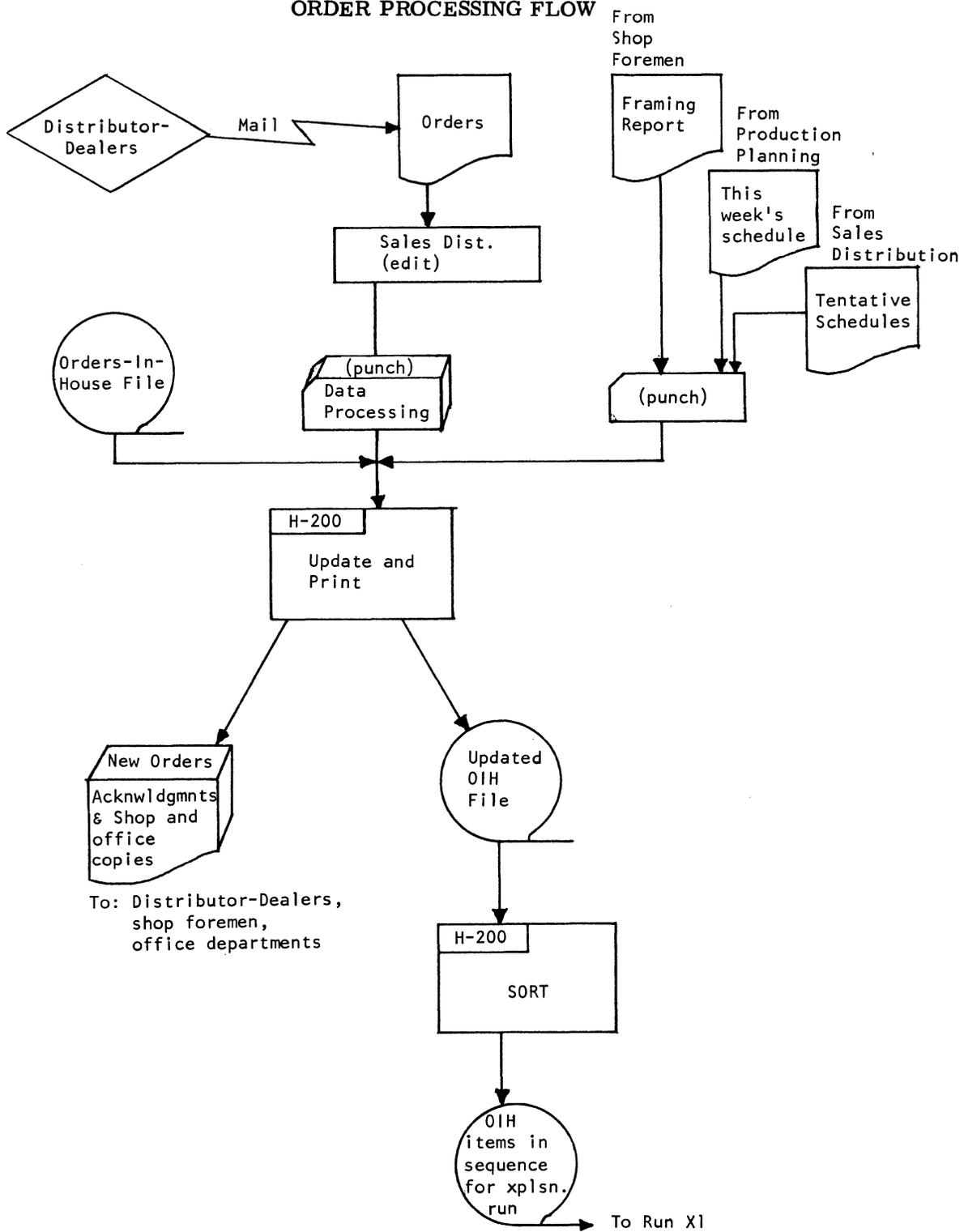
Department 11 Date 2/1/68

**DAILY DEPARTMENTAL REPORT**

| UNITS STARTED |          |          | UNITS COMPLETED |          |          | UNITS HELD UP |          |          |     |
|---------------|----------|----------|-----------------|----------|----------|---------------|----------|----------|-----|
| Model         | Body No. | Sill No. | Model           | Body No. | Sill No. | Model         | Body No. | Sill No. | For |
| 1108          | 3028     | 459      | 1108            | 3028     | 459      |               |          |          |     |
| 1109          | 2752     | 460      | 1109            | 2752     | 460      |               |          |          |     |
| 1109          | 2856     | 461      | 1109            | 2856     | 461      |               |          |          |     |
| 1109          | 2853     | 462      | 1109            | 2853     | 462      |               |          |          |     |
| 1109          | 2066     | 463      | 1109            | 2066     | 463      |               |          |          |     |

WHEN A UNIT SHOWS UP ON A FRAMING REPORT SUBMITTED BY A FOREMAN, IT IS RECLASSIFIED, IN THE ORDERS-IN-HOUSE FILE, AS HAVING BEEN BUILT.

ORDER PROCESSING FLOW



DATA FROM ORDER INPUT, COMBINED WITH INPUT FROM THE SHOP FOREMEN, PRODUCTION PLANNING AND SALES DISTRIBUTION DEPARTMENTS, ARE USED TO UPDATE THE ORDER-IN-HOUSE (OIH) FILE PRIOR TO THE EXPLOSION OF SALES ORDER REQUIREMENTS.

Bill of Material System

Superior uses a level-one bill of material system which shows only the piece parts and assemblies that are actually installed on the assembly line to complete the end product. Superior maintains a stock of items on the assembly line, the quantity depending on the size of the item. Assemblies put together prior to delivery to the production line are kept separate and listed in an assembly parts list file; in addition to showing each assembly, this list shows the components required to make each assembly.

BILL OF MATERIAL

| FORM 470-2 FEB 1965 |           | ENGINEERING BILL OF MATERIAL          |                                                                  | SUPERIOR COACH CORPORATION - LIMA, OHIO |          | QUANTITY PER MODEL AND LENGTH |      |      |      |      |      |      |  |  |  |
|---------------------|-----------|---------------------------------------|------------------------------------------------------------------|-----------------------------------------|----------|-------------------------------|------|------|------|------|------|------|--|--|--|
| PRINT SIZE          |           | ORIGIN CODE                           | FRACTIONS ON SIZE & QUANTITY ARE SHOWN IN TWO (2) DECIMAL PLACES | DIVISION                                | STD. BUS | SERIES                        | 1000 | YEAR | 1968 |      |      |      |  |  |  |
| ITEM NO.            | PART I.D. | DESCRIPTION                           | REMARKS                                                          | +                                       | ALL      | 1049                          | 1059 | 1069 | 1079 | 1089 | 1099 | 1109 |  |  |  |
| 1                   |           | X LAYOUT - U/B HOLD DOWN CROSSMEMBERS | LO-2679-G                                                        |                                         | X        |                               |      |      |      |      |      |      |  |  |  |
| 2                   |           | X LAYOUT - U/B HOLD DOWN CROSSMEMBERS | LO-5182-D                                                        |                                         |          |                               |      |      | X    |      |      |      |  |  |  |
| 3                   |           | X LAYOUT - U/B TO CHASSIS             | LO-5074-H                                                        |                                         | X        |                               |      |      |      |      |      |      |  |  |  |
| 4                   |           | X LAYOUT - C/M U/B FRONT FLOOR PANEL  | LO-3024-G                                                        |                                         | X        |                               |      |      |      |      |      |      |  |  |  |
| 7                   | 321504    | UNDERBODY ASSY                        | ON LO-8715-D                                                     |                                         |          | 1                             |      |      |      |      |      |      |  |  |  |
| 8                   | 321500    | UNDERBODY ASSY                        | ON LO-8715-D                                                     |                                         |          |                               | 1    |      |      |      |      |      |  |  |  |
| 9                   |           | UNDERBODY ASSY                        | ON LO-8715-D                                                     |                                         |          |                               |      | 1    |      |      |      |      |  |  |  |
| 10                  |           | UNDERBODY ASSY                        | ON LO-8719-D                                                     |                                         |          |                               |      |      | 1    |      |      |      |  |  |  |
| 11                  |           | UNDERBODY ASSY                        | ON LO-8719-D                                                     |                                         |          |                               |      |      |      | 1    |      |      |  |  |  |

ASSEMBLY PARTS LIST

| FABRICATED ASSY. PARTS LIST, COMPLETE LISTING-CURRENT ASSYS.      |              |                  |          |       |           |               |      |                                  |  | 11-18-67          | PAGE 672  |
|-------------------------------------------------------------------|--------------|------------------|----------|-------|-----------|---------------|------|----------------------------------|--|-------------------|-----------|
| LEVEL 1 ASSYS. WITH COMPONENTS FROM ALL LEVELS.                   |              |                  |          |       |           |               |      |                                  |  | ISSUE DATE        |           |
| ASSEMBLIES FOR ALL MODELS EXCEPT CADILLAC, PONTIAC AND VAN BODIES |              |                  |          |       |           |               |      |                                  |  | LEVEL 1 ASSY. NO. |           |
| DWG. SIZE                                                         | ASSY. NUMBER | COMPONENT NUMBER | SEQ. NO. | LEVEL | ORG. CODE | QTY PER ASSY. | UOM  | DESCRIPTION AND REMARKS          |  |                   | ASSY. NO. |
|                                                                   | 321499       | 266615           | 10       | 3     | 1         | 3.            | EACH | PANEL - U/B FLOOR ON B-62737     |  |                   | 321499    |
|                                                                   |              | 266560           | 11       | 3     | 1         | 3.            | EACH | C/MEMBER INTERMEDIATE ON B 62735 |  |                   |           |
|                                                                   |              | 266614           | 12       | 2     | 1         | 1.            | EACH | PANEL - U/B FLOOR ON B-62737     |  |                   |           |
|                                                                   |              | 322859           | 13       | 2     | 2         | 1.            | EACH | FLR ASSY - WH*OUSE ON D-322857   |  |                   |           |
|                                                                   |              | 322775           | 14       | 3     | 1         | 2.            | EACH | X/MEMBER - U/B ON B-62734        |  |                   |           |
|                                                                   |              | 322862           | 15       | 3     | 1         | 2.            | EACH | STRNR - W/H FRAME ON B-322860    |  |                   |           |
|                                                                   |              | 322866           | 16       | 3     | 1         | 2.            | EACH | STRNR - W/H FRAME ON B-322860    |  |                   |           |
|                                                                   |              | 322869           | 17       | 3     | 1         | 3.            | EACH | STRNR - W/H FRAME ON B-322867    |  |                   |           |
|                                                                   |              | 317852           | 18       | 3     | 1         | 1.            | EACH | *PANEL - RR W/H FLR ON A-316079  |  |                   |           |
|                                                                   |              | 318435           | 19       | 2     | 1         | 2.            | EACH | PANEL - RR W/LLER ON B-318437    |  |                   |           |
|                                                                   |              | 318608           | 20       | 3     | 1         | 2.            | EACH | *PANEL - W/H 50 1125             |  |                   |           |

Before computerizing the bill of material system, Superior used an all-level bill of material. With this system, many assemblies--along with their components--were repeated several times throughout the bill of material. Changing over to the level-one bill of material system resulted in a considerable reduction in time required to process these files. Also, the volume of file maintenance and printing was cut by about one-third.

The multiple columns in the bill of material made sequential calculations of requirements virtually impossible. Because of this, a "where used" tape file was created. This file carries a separate item for each specific usage of any item. This makes it possible to calculate parts requirements sequentially in a way that is compatible with sequencing of sales order requirements in the orders-in-house file.

The relationship of the bill of material, assembly parts list and where-used file may be more clearly understood by taking a look at one example. Line 8 of the bill of material (below) shows the level one assembly number 321500.

| FORM 470-2 FEB 1965 |           | ENGINEERING BILL OF MATERIAL          |                                                                  | SUPERIOR COACH CORPORATION - LIMA, OHIO |          | QUANTITY PER MODEL AND LENGTH |      |      |      |      |      |      |  |  |  |
|---------------------|-----------|---------------------------------------|------------------------------------------------------------------|-----------------------------------------|----------|-------------------------------|------|------|------|------|------|------|--|--|--|
| PRINT SIZE          |           | ORIGIN CODE                           | FRACTIONS ON SIZE & QUANTITY ARE SHOWN IN TWO (2) DECIMAL PLACES | DIVISION                                | STD. BUS | SERIES                        | 1000 | YEAR | 1968 |      |      |      |  |  |  |
| ITEM NO.            | PART I.D. | DESCRIPTION                           | REMARKS                                                          | +                                       | ALL      | 1049                          | 1059 | 1069 | 1079 | 1089 | 1099 | 1109 |  |  |  |
| 1                   |           | X LAYOUT - U/B HOLD DOWN CROSSMEMBERS | LO-2679-G                                                        |                                         | X        |                               |      |      |      |      |      |      |  |  |  |
| 2                   |           | X LAYOUT - U/B HOLD DOWN CROSSMEMBERS | LO-5182-D                                                        |                                         |          |                               |      |      | X    |      |      |      |  |  |  |
| 3                   |           | X LAYOUT - U/B TO CHASSIS             | LO-5074-H                                                        |                                         | X        |                               |      |      |      |      |      |      |  |  |  |
| 4                   |           | X LAYOUT - C/M U/B FRONT FLOOR PANEL  | LO-3024-G                                                        |                                         | X        |                               |      |      |      |      |      |      |  |  |  |
| 8                   |           | UNDERBODY ASSY                        | ON LO-8715-D                                                     |                                         |          | 1                             |      |      |      |      |      |      |  |  |  |

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This assembly, 321500, is constructed from the items shown in the assembly parts list (below).

| FABRICATED ASSY. PARTS LIST, COMPLETE LISTING-CURRENT ASSYS.      |              |                  |          |         |           |               |      |                                  |  | 11-18-67          | PAGE 672          |
|-------------------------------------------------------------------|--------------|------------------|----------|---------|-----------|---------------|------|----------------------------------|--|-------------------|-------------------|
| LEVEL 1 ASSYS. WITH COMPONENTS FROM ALL LEVELS.                   |              |                  |          |         |           |               |      |                                  |  | ISSUE DATE        |                   |
| ASSEMBLIES FOR ALL MODELS EXCEPT CADILLAC, PONTIAC AND VAN BODIES |              |                  |          |         |           |               |      |                                  |  | LEVEL 1 ASSY. NO. |                   |
| DWG. SIZE                                                         | ASSY. NUMBER | COMPONENT NUMBER | SEQ. NO. | -LEVEL- | ORG. CODE | QTY PER ASSY. | UOM  | DESCRIPTION AND REMARKS          |  |                   | LEVEL 1 ASSY. NO. |
|                                                                   | 321499       | 266615           | 10       | 3       | 1         | 3.            | EACH | PANEL = U/B FLOOR ON B-62737     |  |                   | 321499            |
|                                                                   |              | 266560           | 11       | 3       | 1         | 3.            | EACH | C/MEMBER INTERMEDIATE ON B-62735 |  |                   |                   |
|                                                                   |              | 266614           | 12       | 2       | 1         | 1.            | EACH | PANEL = U/B FLOOR ON B-62737     |  |                   |                   |
|                                                                   |              | 322859           | 13       | 2       | 2         | 1.            | EACH | FLR ASSY = WH*OUSE ON D-322857   |  |                   |                   |
|                                                                   |              | 322775           | 14       | 3       | 1         | 2.            | EACH | X/MEMBER = U/B ON B-62734        |  |                   |                   |
|                                                                   |              | 322862           | 15       | 3       | 1         | 2.            | EACH | STRNR = W/H FRAME ON B-322860    |  |                   |                   |
|                                                                   |              | 322866           | 16       | 3       | 1         | 2.            | EACH | STRNR = W/H FRAME ON B-322860    |  |                   |                   |
|                                                                   |              | 322869           | 17       | 3       | 1         | 3.            | EACH | STRNR = W/H FRAME ON B-322867    |  |                   |                   |
|                                                                   |              | 317852           | 18       | 3       | 1         | 1.            | EACH | PANEL = RR W/H FLR ON A-316079   |  |                   |                   |
|                                                                   |              | 318435           | 19       | 2       | 1         | 2.            | EACH | PANEL = RR W/*LLER ON B-318434   |  |                   |                   |
|                                                                   |              | 318508           | 20       | 2       | 1         | 2.            | EACH | ANGLE = W/H 5* U/B ON A-316780   |  |                   |                   |
|                                                                   | 321500       |                  | 1        | 1       | 2         | 1.            | EACH | UNDERBODY ASSY ON LO-8115-D      |  |                   | 321500            |
|                                                                   |              | 266673           | 2        | 2       | 2         | 1.            | EACH | PANEL ASSY = *BODY ON C-266672   |  |                   |                   |
| B                                                                 |              | 62737            | 3        | 3       | 1         | 1.            | EACH | PANEL = UNDERBODY                |  |                   |                   |
| B                                                                 |              | 62735            | 4        | 3       | 1         | 1.            | EACH | CROSSMEMBER = INTER              |  |                   |                   |
|                                                                   |              | 62736            | 5        | 3       | 1         | 1.            | EACH | CROSSMEMBER = *TE #2 ON U-62735  |  |                   |                   |
|                                                                   |              | 266670           | 6        | 2       | 2         | 2.            | EACH | PANEL ASSY = *BODY ON C-266669   |  |                   |                   |
| B                                                                 |              | 62737            | 7        | 3       | 1         | 2.            | EACH | PANEL = UNDERBODY                |  |                   |                   |
| B                                                                 |              | 62735            | 8        | 3       | 1         | 4.            | EACH | CROSSMEMBER = INTER              |  |                   |                   |
|                                                                   |              | 266676           | 9        | 2       | 2         | 1.            | EACH | PANEL ASSY = *BODY ON C-266675   |  |                   |                   |
|                                                                   |              | 62739            | 10       | 3       | 1         | 1.            | EACH | PANEL = UNDERBODY ON B-62737     |  |                   |                   |
| B                                                                 |              | 62735            | 11       | 3       | 1         | 1.            | EACH | CROSSMEMBER = INTER              |  |                   |                   |
|                                                                   |              | 262335           | 12       | 2       | 1         | 1.            | EACH | PANEL = U/B FR W/H ON B-62737    |  |                   |                   |
|                                                                   |              | 322858           | 13       | 2       | 2         | 1.            | EACH | FLOOR ASSY = *OUSE ON D-322857   |  |                   |                   |
|                                                                   |              | 322775           | 14       | 3       | 1         | 2.            | EACH | X/MEMBER = U/B ON B-62734        |  |                   |                   |
|                                                                   |              | 322861           | 15       | 3       | 1         | 2.            | EACH | STRAINER = W/*FRAME ON B-322860  |  |                   |                   |
|                                                                   |              | 322865           | 16       | 3       | 1         | 2.            | EACH | STRAINER = W/*FRAME ON B-322860  |  |                   |                   |
|                                                                   |              | 322868           | 17       | 3       | 1         | 3.            | EACH | STRAINER = W/*FRAME ON B-322867  |  |                   |                   |
| A                                                                 |              | 316079           | 18       | 3       | 1         | 1.            | EACH | PANEL = REAR W/H FLOOR           |  |                   |                   |
|                                                                   |              | 318436           | 19       | 2       | 1         | 2.            | EACH | PANEL = FRT 4* W/H ON B-318434   |  |                   |                   |
|                                                                   |              | 320477           | 20       | 2       | 1         | 2.            | EACH | REINF BELT RAIL 55 IN            |  |                   |                   |
|                                                                   | 321501       |                  | 1        | 1       | 2         | 1.            | EACH | UNDERBODY ASSY ON LO-8715-D      |  |                   | 321501            |
|                                                                   |              | 266674           | 2        | 2       | 2         | 1.            | EACH | PANEL ASSY U/*Y #2 ON C-266672   |  |                   |                   |

The specific usages of 321500 are shown on the where-used list (below).

| ORI-<br>GIN<br>CODE | PART<br>NO. | NAME      | OR     | U | *****QTY - ON S.E. | OR          | *****QTY - ON S.E. | OR          | *****QTY - ON S.E. | **** B | DIV.          | ON<br>ASSY.<br>NO. |
|---------------------|-------------|-----------|--------|---|--------------------|-------------|--------------------|-------------|--------------------|--------|---------------|--------------------|
|                     |             |           | M      | * | VAR. MODEL*        | VAR. MODEL* | VAR. MODEL*        | VAR. MODEL* | VAR. MODEL*        | #      | SE# PAGE LINE |                    |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 519 1118         |             |                    |             |                    | 12     | 12317 6       | 7C X 320855        |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 520 1099         |             |                    |             |                    | 12     | 12317 8       | 4C 320789          |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 520 1109         |             |                    |             |                    | 12     | 12317 8       | 5C 320797          |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 520 1119         |             |                    |             |                    | 12     | 12317 8       | 6C 321317          |
| 1                   | 321495      | SILL - LM | +01    | 1 | V 520 1078         |             |                    |             |                    | 12     | 12317 11      | 21C 323009         |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 520 1078         |             |                    |             |                    | 12     | 12317 12      | 3C 320885          |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 520 1088         |             |                    |             |                    | 12     | 12317 12      | 4C 320893          |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 520 1098         |             |                    |             |                    | 12     | 12317 12      | 5C 320901          |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 520 1118         |             |                    |             |                    | 12     | 12317 12      | 6C 320909          |
| 1                   | 321495      | SILL - LM | +01    | 1 | V 540 1119         |             |                    |             |                    | 12     | 12317 12      | 7C 320857          |
| 1                   | 321495      | SILL - LM | +01    | 1 | V 540 1118         |             |                    |             |                    | 12     | 12338 2       | 25C 321311         |
| 1                   | 321495      | SILL - LM | +01    | 1 | V 540 1119         |             |                    |             |                    | 12     | 12338 2       | 26C X 320855       |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 540 1118         |             |                    |             |                    | 12     | 12338 2       | 34C 320795         |
| 1                   | 321495      | SILL - LM | +01    | 1 | V 541 1119         |             |                    |             |                    | 12     | 12338 2       | 35C 320907         |
| 1                   | 321495      | SILL - LM | +01    | 1 | V 541 1118         |             |                    |             |                    | 12     | 12338 3       | 19C 321317         |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 541 1119         |             |                    |             |                    | 12     | 12338 3       | 20C 320857         |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 541 1118         |             |                    |             |                    | 12     | 12338 3       | 30C 320797         |
| 1                   | 321495      | SILL - LM | -01    | 1 | V 541 1118         |             |                    |             |                    | 12     | 12338 3       | 31C 320909         |
| 2                   | 321498      | UNDERBODY | +01    | 1 | 1058               |             |                    |             |                    | 11     | 11 1          | 7                  |
| 2                   | 321498      | UNDERBODY | -01    | 1 | S 11640 1058       |             |                    |             |                    | 12     | 11640 9       | 11                 |
| 2                   | 321499      | UNDERBODY | +01    | 1 | S 11640 1058       |             |                    |             |                    | 12     | 11640 3       | 11                 |
| 2                   | 321500      | UNDERBODY | +01*   | 1 | 1058               |             | 1099               |             |                    | 11     | 1 3           | 8                  |
| 2                   | 321500      | UNDERBODY | -01**  | 1 | 1058               |             |                    |             |                    | 11     | 11 11         | 28                 |
| 2                   | 321500      | UNDERBODY | -01    | 1 | S 11640 1059       |             |                    |             |                    | 12     | 11640 9       | 8                  |
| 2                   | 321501      | UNDERBODY | +01*** | 1 | S 11640 1058       |             |                    |             |                    | 12     | 11640 3       | 8                  |
| 2                   | 321501      | UNDERBODY | +01    | 1 | S 11640 1058       |             |                    |             |                    | 12     | 11640 3       | 8                  |

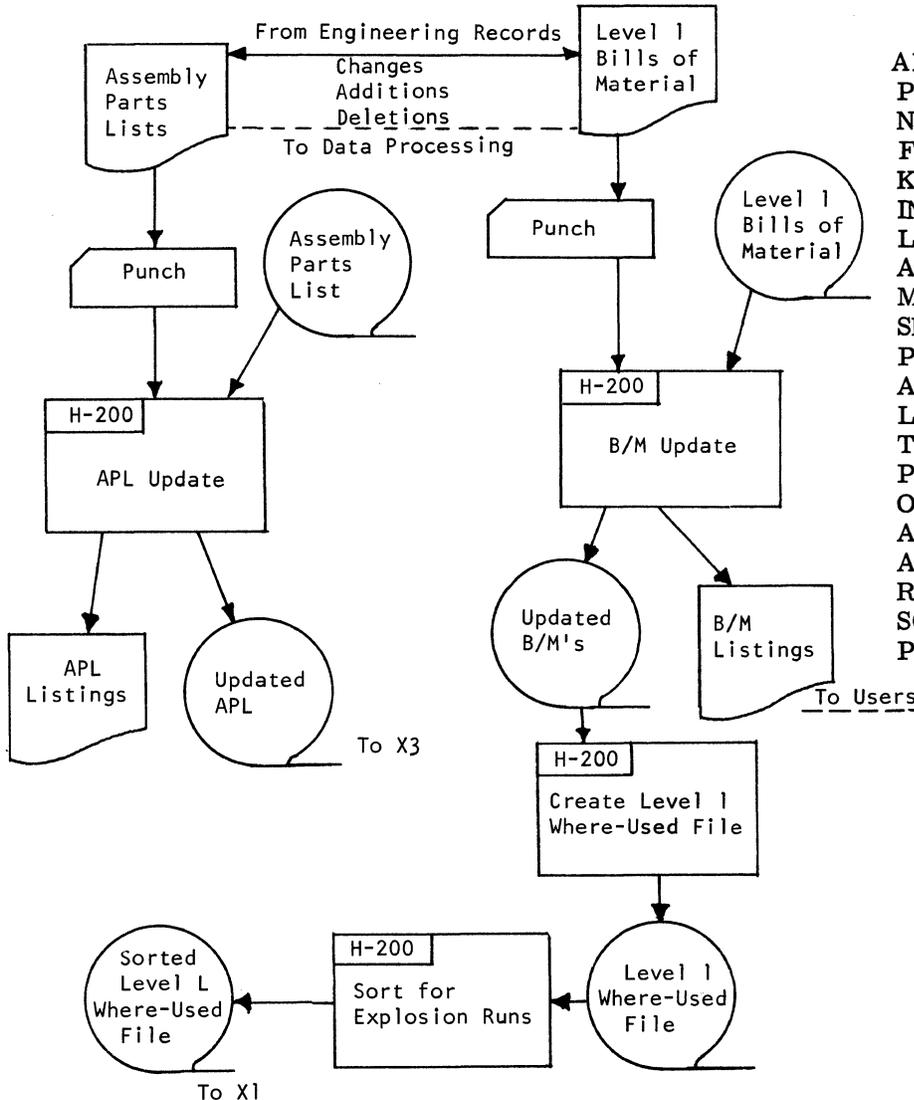
The usage marked \* indicates that 321500 is used on models 1058 and 1059. The usage marked \*\* shows a deduct of this same assembly on model 1058. This is due to the fact the bill of material for model 1058 is written as a modification of the 1059. Such a deduction indicates that some other assembly is used on the model 1058.

The usage marked \*\*\* is for standard extra 11640 (also an "add to" and "deduct from" type of bill of material). This usage indicates that when a model 1059 requires standard extra 11640, assembly 321500 is deducted from the requirements and assembly 31501 is used in its place.

The where-used listing includes items from all levels of the product and shows all assembly components. Since this list indicates that the items shown are in some bill of material location, assembly components are identified by the suffix "c" following the line number (see X's marked on printout on page 7). The level one assembly, of which such an item is a component, is shown at the extreme right side of the listing. This listing doubles as an assembly component where-used list because it can be used to determine what assemblies require any given part. Since the list is composed of specific individual usages, components are shown with their level-one assembly for each bill of material location where the level-one assembly is specified. For example, part number 321495 is a component of assembly 320855 (marked X). This assembly is shown in two bill of material locations--standard extra 12317, page 6, line 7 and standard extra 12338, page 2, line 26.

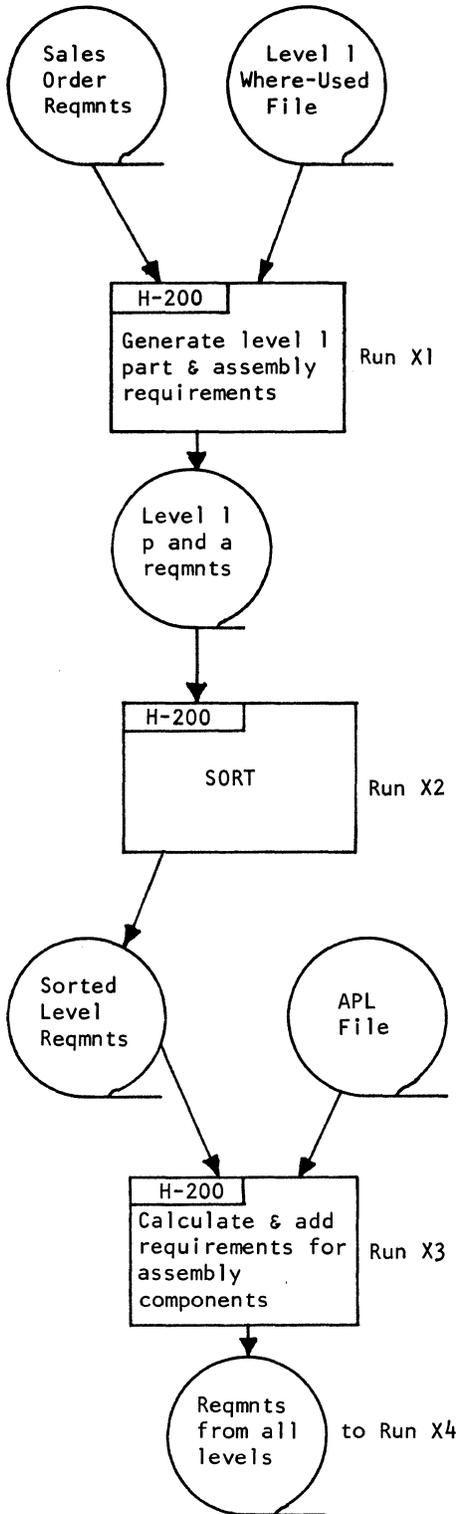
Assembly parts lists and bills of material are used on the production line in assembling the products. Using the sales release order, the foremen at specific locations along the line can then refer to the assembly parts list and bill of material for information on the requirements to build the particular assembly on which they are working.

DATA FLOW FOR BILL OF MATERIAL AND ASSEMBLY PARTS LISTING UPDATING



ALTERATIONS TO EXISTING PARTS, OR ADDITIONS OF NEW PARTS, ARE RECEIVED FROM ENGINEERS THEN KEYPUNCHED FOR ENTRY INTO THE ASSEMBLY PARTS LIST FILE. THESE CHANGES AFFECT THE BILL OF MATERIALS FILE, WHICH SHOWS WHICH PIECE PARTS AND ASSEMBLIES ARE ON THE ASSEMBLY LINE. DATA OUTPUT FROM THIS RUN--ASSEMBLY PARTS LISTINGS AND BILL OF MATERIAL LISTINGS--ARE USED IN THE SHOP, ALONG WITH SALES RELEASE ORDERS, TO SCHEDULE AND CONTROL PRODUCTION.

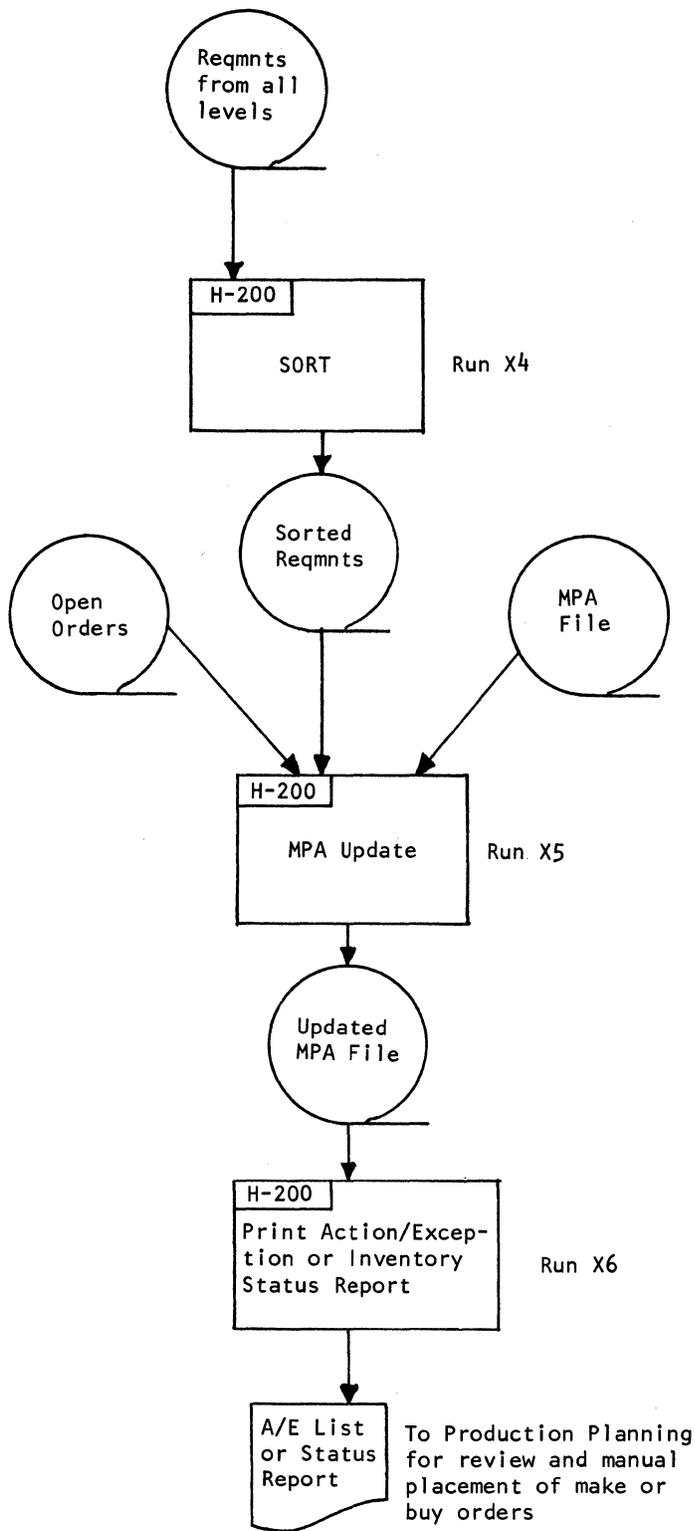
EXPLOSION OF PARTS REQUIREMENTS



Run X1--Sales order requirements are matched with where-used file and all piece-parts and assemblies required are pulled off onto a separate tape. These are level one requirements.

Run X2--Level one requirements sorted into part number sequence.

Run X3--Level one requirements are matched against assembly parts list file. Where appropriate, components for assembly are pulled as requirements.



Run X4--Level one requirements are combined with requirements on assembly components and sorted into part number sequence.

Run X5--Open order activity is recorded on the master parts and assemblies file and adjustments are made to reflect sales order requirements.

Run X6--Inventory status report (or action/exception listing) is printed.

SUPERIOR COACH CORP.

Fabricated and Purchase Orders

Data on these orders is carried on a magnetic tape open order file which is updated weekly. Each open order shows: part number, order number, order issue date, due date, receival number, receival date, quantity received. This data is summarized and carried on the master parts and assembly file, updated during the explosion of requirements processing run.

Miscellaneous Inventory Activities

Adjustments to the master parts and assemblies file are made on the basis of input from various departments. Some adjustments to the file and their sources are: addition of new items (from engineering and production planning departments), service department usage (from service department), scrappage (inspection department), changes in inventory balance (production planning department), interplant shipments (production planning department) "hold" notices or cancellations (engineering). Input of this data is accomplished just prior to the explosion of requirements run.

INVENTORY STATUS REPORT

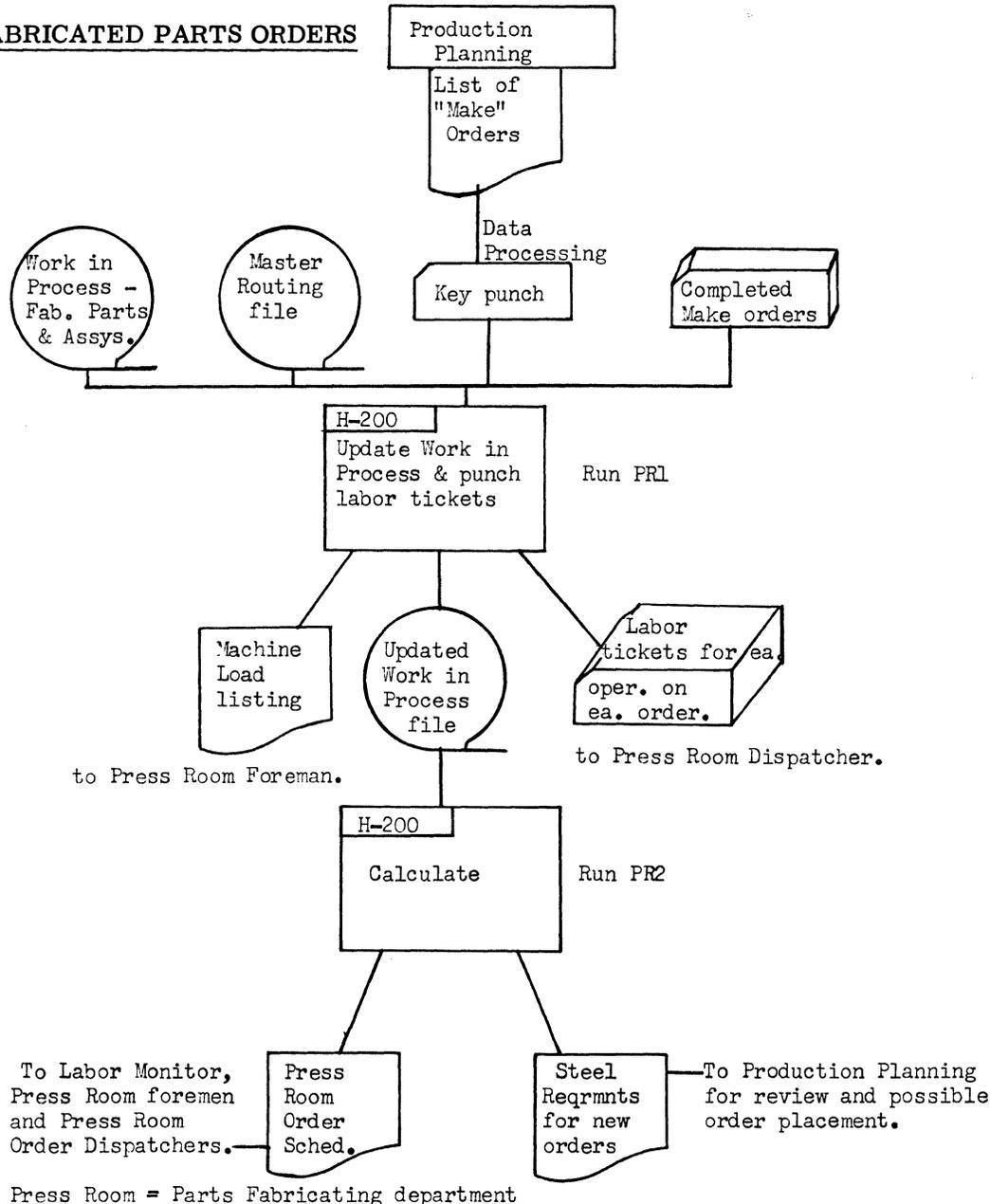
| LIMA INVENTORY STATUS REPORT DECEMBER 18, 1967 |     |     |       |       |       |        |      |         |         |        |       |       |         |       | PAGE 72 |
|------------------------------------------------|-----|-----|-------|-------|-------|--------|------|---------|---------|--------|-------|-------|---------|-------|---------|
| P                                              | L   | U   | EST.  | TOTAL |       | FRAMED | ON   | FRAMING | TENT-   | ON     | RE-   | OFF-  | STORES  | TERM- | L       |
| PART                                           | NO. | NO. | YEARS | ON    | RECVD | USAGE  | HAND | REQUIRE | ATIVE   | ORDER  | ORDER | LINE  | BALANCE | INAL  | A       |
| NO.                                            |     |     | USAGE | OPEN  | Y-T-D | Y-T-D  |      | MENTS   | REQUIRE | DUE IN | POINT | USAGE |         | DATA  | D       |
| 360234                                         | 2   | 01  | 800   | 150   | 500   | 260    | 451  | 23      | 44      | 0      | 384   | 330   | 190     | 0     | 16      |
| 360240                                         | 2   | 01  | 4140  | 0     | 0     | 348    | 190  | 38      | 69      | 0      | 82    | 120   | 160     | 106   | 4       |
| 360241                                         | 2   | 01  | 1140  | 0     | 0     | 348    | 313  | 39      | 69      | 0      | 205   | 120   | 160     | 103   | 4       |
| 360242                                         | 2   | 01  | 1140  | 0     | 0     | 348    | 190  | 39      | 69      | 0      | 82    | 120   | 140     | 118   | 4       |
| 360243                                         | 2   | 01  | 1140  | 0     | 0     | 348    | 215  | 39      | 69      | 0      | 107   | 120   | 140     | 116   | 4       |
| 360244                                         | 2   | 01  | 350   | 0     | 271   | 105    | 397  | 13      | 20      | 0      | 364   | 30    | 70      | 50    | 4       |
| 360245                                         | 2   | 01  | 870   | 270   | 350   | 278    | 2002 | 28      | 49      | 0      | 1925  | 230   | 330     | 81    | 10      |
| 360258                                         | 2   | 01  | 940   | 121   | 482   | 298    | 367  | 35      | 57      | 121L   | 396   | 100   | 240     | 441   | 10      |
| 360259                                         | 2   | 01  | 940   | 80    | 489   | 297    | 345  | 35      | 56      | 80L    | 334   | 100   | 240     | 953   | 4       |
| 360260                                         | 2   | 01  | 6980  | 4700  | 0     | 2334   | 2512 | 244     | 332     | 0      | 1941  | 2560  | 4580    | 0     | 14      |
| 360261                                         | 2   | 01  | 4600  | 0     | 3500  | 1444   | 4970 | 164     | 276     | 0      | 4530  | 1680  | 3710    | 0     | 14      |
| 360266                                         | 2   | 01  | 170   | 0     | 0     | 50     | 91   | 4       | 12      | 0      | 75    | 40    | 130     | 0     | 10      |
| 360267                                         | 2   | 01  | 170   | 60    | 40    | 51     | 90   | 4       | 13      | 0      | 75    | 50    | 130     | 0     | 10      |
| 360268                                         | 2   | 01  | 570   | 0     | 275   | 189    | 499  | 21      | 30      | 0      | 448   | 150   | 240     | 2     | 10      |
| 360269                                         | 2   | 01  | 570   | 0     | 511   | 189    | 482  | 21      | 30      | 0      | 431   | 150   | 240     | 3     | 10      |
| 360270                                         | 2   | 01  | 570   | 230   | 242   | 175    | 122  | 24      | 40      | 0      | 58    | 150   | 240     | 7     | 10      |
| 360271                                         | 2   | 01  | 580   | 225   | 215   | 186    | 102  | 17      | 29      | 0      | 56    | 150   | 230     | 19    | 10      |
| 360272                                         | 2   | 01  | 570   | 270   | 279   | 175    | 96   | 24      | 40      | 0      | 32    | 150   | 280     | 7     | 10      |
| 360273                                         | 2   | 01  | 570   | 270   | 0     | 175    | 88   | 24      | 40      | 0      | 24    | 150   | 280     | 6     | 10      |
| 360290                                         | 2   | 01  | 540   | 335   | 150   | 173    | 47   | 15      | 29      | 215    | 218   | 110   | 60      | 25    | 3       |
| 360306                                         | 2   | 01  | 3060  | 0     | 6500  | 920    | 9442 | 104     | 184     | 0      | 9174  | 1070  | 2120    | 300   | 14      |
| 360308                                         | 2   | 01  | 510   | 108   | 174   | 146    | 47   | 17      | 38      | 58     | 50    | 240   | 60      | 4     | 10      |
| 360309                                         | 2   | 01  | 510   | 110   | 183   | 146    | 62   | 17      | 38      | 60     | 67    | 240   | 60      | 5     | 10      |
| 360311                                         | 2   | 01  | 4250  | 0     | 1500  | 1314   | 2657 | 117     | 268     | 0      | 2252  | 1560  | 1490    | 0     | 10      |
| 360323                                         | 2   | 01  | 2300  | 0     | 1200  | 722    | 987  | 82      | 138     | 0      | 767   | 600   | 1210    | 1     | 10      |
| 360323                                         | 2   | 01  | 1880  | 0     | 0     | 595    | 1177 | 70      | 113     | 0      | 994   | 490   | 820     | 0     | 10      |
|                                                |     |     |       | 0     | 750   | 576    | 811  | 46      |         |        |       | 490   | 770     | 1685  | 0       |
|                                                |     |     |       | 0     | 430   | 361    |      |         |         |        |       |       | 110     | 0     |         |

The inventory status report is primarily a reference listing. The action/exception listing shows only the items (above) on which there is some "flag" to the right of the "stores balance" column. A flag indicates that some action probably is required on the item. For example, \*\*\* indicates that quantity on hand is less than framing requirements; \* means that what is available is less than the re-order point; CK\* indicates that the stores balance on special items is zero; OAU indicates that quantity on hand plus total on order is more than 10 percent above the estimated usage for the year.

Column headings on the inventory status report and definitions follow: PART NO.--Superior's number to identify raw material, purchased part or assembly, or fabricated part or assembly, used in producing the end product; PLNR--the individual in the production planning department responsible for inventory of the item; UOM--unit of measure code; EST. YEARS USAGE--estimate of requirements for this year's production; TOTAL ON OPEN ORDERS: RECVD Y-T-D--total quantity received during the model year, referring to parts unique to a certain product line (can also mean total quantity received since annual physical inventory on items used on more than one product line); FRAMED USAGE Y-T-D--production

line usage of the item, year to date; ON HAND--computer-calculated balance at the end of "last week's" production; FRAMING REQUIREMENTS-- quantity need for "this week's" production; TENTATIVE REQUIREMENTS--quantity required for production scheduled for four-week period following this week; ON ORDER, DUE IN 30 DAYS--an L next to figures in this column indicates some portion of that quantity is late in arriving; AVAILABLE-- an "on hand" figure for approximately the next five weeks; REORDER POINT--inventory level at which item status must be reviewed for either a "make" or "buy" order; E. O. Q. -- Most economical quantity to order, based on costs and estimated usage; OFF-LINE USAGE-- summation of shipments to other plants, scrappage, service department usage, or other disposition not directly connected with product assembly; STORE BALANCE--unrequisioned balance in the store room (some items are not yet under automated scrutiny and this column is to assist planners in periodic review of such items; for example, fasteners used at many production line stations can be "lost" without such information reaching data processing); TERMINAL DATA--information such as "cancel" or "hold" (for revision or cancellation) received from the engineering division; LEAD--number of weeks required to receive a shipment after the order has been placed.

FABRICATED PARTS ORDERS



From a review of the inventory status report (or action/exception listing), production planning issues a list of "make" orders which are keypunched and input for run PR1.

These new orders are added to the work-in-process file. A deck of cards is punched, one card for each operation, on new orders. These cards are used in the press room (sheet metal parts fabrication department) for work assignment. The cards are returned to the DP department after each operation is completed. New orders, plus data from work in progress file, is used to produce the press room order schedule and ascertain material requirements for new orders.

### FORECASTING

Three factors are used to estimate annual requirements: (1) sales forecast, which reflects anticipated changes in the trend of sales to date; (2) orders in house, which is the current sales trend and, therefore, the dominant factor; (3) last year's sales orders. Before any calculations are made, the orders in house and last year's sales orders are adjusted to this year's "base."

For example, assume the sales forecast to be for 1,100 units. If last year's sales orders were for 1,000 units, each component of these orders would be increased by 10 percent (1,000 plus 10 percent equals this year's base of 1,100). If the orders in house total 550 units, each component of these orders would be increased by 100 percent (550 plus 100 percent equals 1,100).

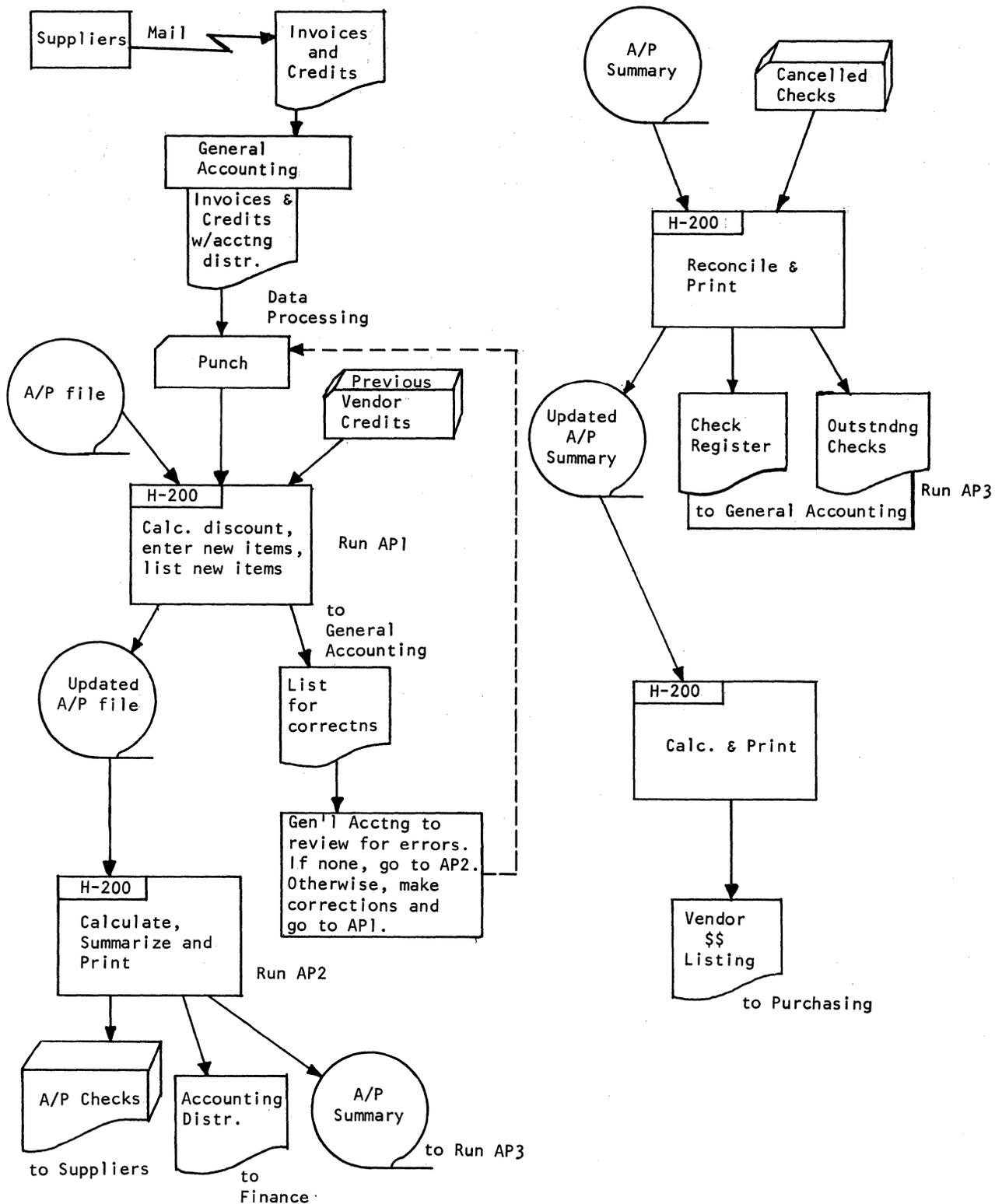
After adjustments are made so that all three factors have the same base figure, a weighting procedure is used to calculate a year's requirements that is most apt to be correct. The weighting factors (totaling 100 percent) are governed by the following logic: influence of the sales forecast decreases with the aging of the forecast and/or receipt of more orders; as more orders are received, the influence of this factor is increased; influence of last year's sales order decreases as the year progresses. The weighting procedure is done three or four times a year.

The calculations described above are made on models, standard extras and variants. After these calculations are made, the requirements are run through an explosion-type series of programs to ascertain the estimated annual requirements on all assemblies and piece parts.

Seven processing runs are required to produce the final master parts and assemblies tape file with the new estimated annual requirements. After the first run, which adjusts figures on orders in house and last year's sales orders to this year's base, a printout goes to a management committee representing sales, engineering, manufacturing, production planning and purchasing. This committee reviews the listing and makes modifications where required; for example, a specific model may be discontinued, shop facilities may be increased or a large new order may be pending.

### ACCOUNTS PAYABLE SYSTEM

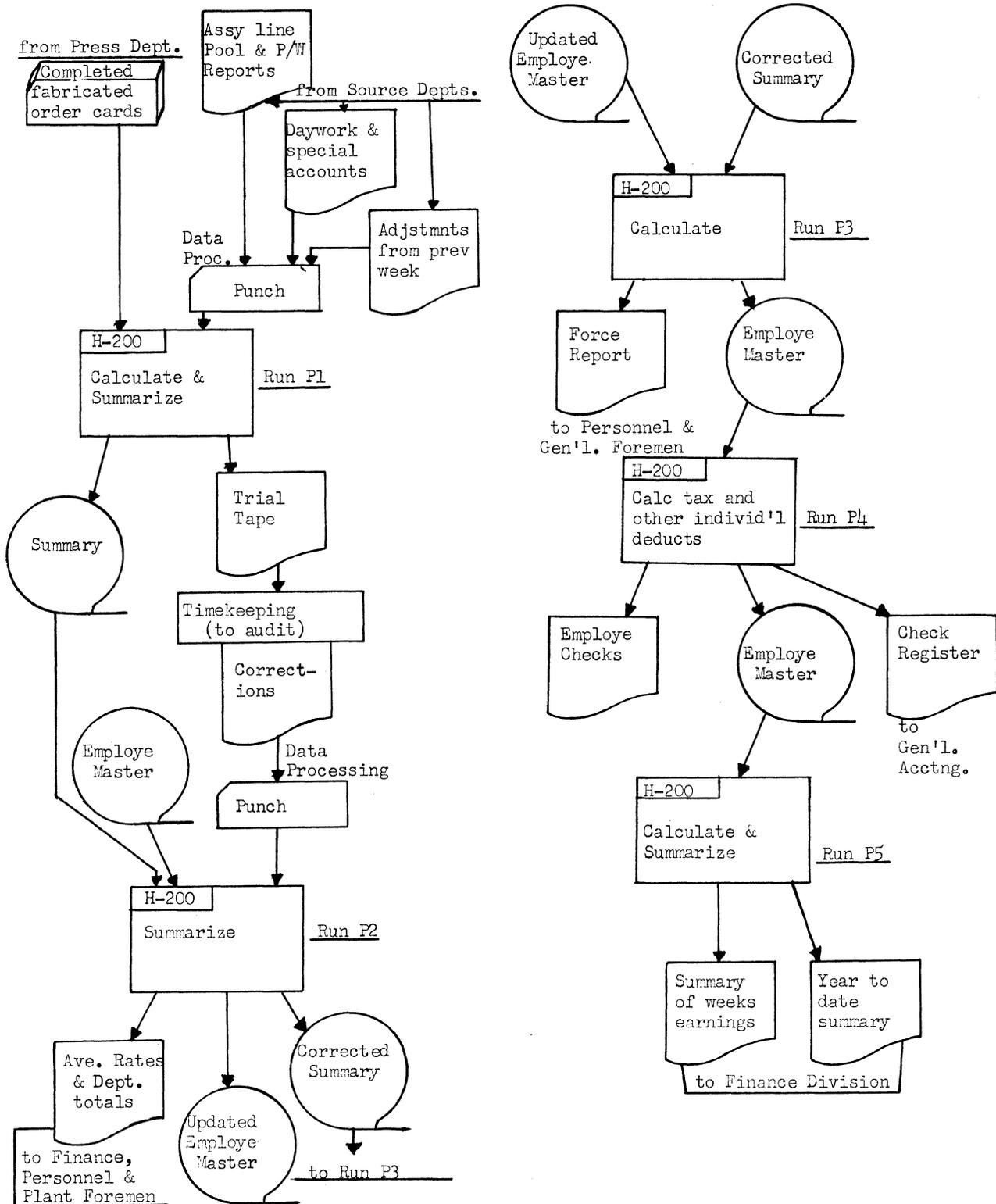
Input from suppliers is keypunched for entry into the system. After the accounts payable (A/P) file is updated, checks are printed and mailed to suppliers, an accounting distribution report is printed for finance, and an A/P summary is created on magnetic tape. A/P summary provides input for the check reconciliation run which results in output for the general accounting office. From the updated A/P summary, a list of vendors with the amount paid to each is printed out for the purchasing department.



ACCOUNTS PAYABLE SYSTEM

PAYROLL

All factory labor charges are entered into the system after being audited for correctness of units of work reported finished, rates charged for the work and hours of attendance. Average rates for individuals, pools and departments are recapped along with accounting distribution for the week. Individual pay is calculated, checks printed and a complete summary forwarded to the finance department for budget review.



RESULTS AND FUTURE PLANS

In the period since November 1964, Superior has realized a considerable savings in its investment in inventory. At the same time, improvements in the other areas of processing have resulted in quicker and more knowledgeable decisions that have, in turn, made plant operations more economical and efficient. Implementation of the computer required a coordination and clean-up of operating data which, in itself, has contributed greatly to Superior's resumption of its role as a dynamic and growing organization.

Superior will continue to expand its computer operation toward the "total system" concept, not only at Lima but also at the plants in Norwalk and Kosciusko. The company anticipates no great problems in having all three plants operating under a "total systems" concept that will continually be under scrutiny for further refinements.