file
Receiving

SPECIAL Modern Materials Handling REPORT

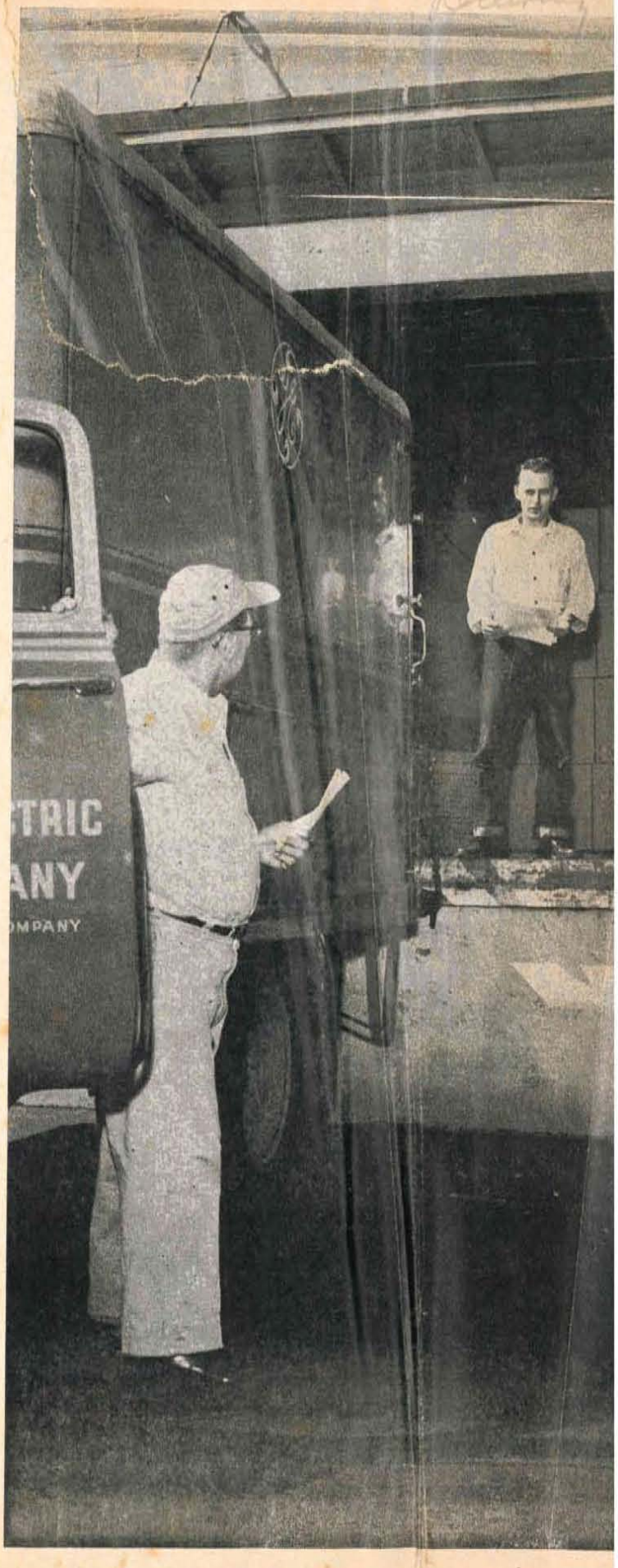
How to Plan Receiving Operations

PART I

Here is the first part of a comprehensive report on how to obtain an efficient receiving operation. Top management, focusing more and more attention on this area, now recognizes it as a gateway of opportunity for cost reduction often overlooked in the past.

Based on text material from General Electric Company's highly successful Receiving Operations Workshops, here are proven methods to help you analyze your own operation, make improvements and measure performance. This complete story offers you several sure-fire ways of providing a faster, more accurate and economical receiving service.

By Henry G. Weiss, *Associate Editor in cooperation with the Production Control Service, General Electric Co.*



HOW TO PLAN RECEIVING . . .

Integrating Receiving with Other Functions

Receiving is the process of accepting materials. It begins with the availability of a delivery vehicle for unloading and continues until the material received arrives at the use or normal stocking point. This includes the receipt and issuance of all necessary information related to the process.

A receiving operation may give the semblance of efficiency when considered alone. But when it causes problems in other parts of the manufacturing cycle (such as stock-keeping, production control, purchasing, or accounting), its performance is open to criticism.

It is important that the receiving information system be well integrated within the overall data processing system of a manufacturing facility. Likewise materials handling in receiving must be integrated to move materials well into the manufacturing cycle. Economies in receiving should not be achieved at the expense of other functions.

One measure of integration is the efficiency with which material is handled before and after passing through the receiving system. Materials handling should be coordinated so that economical handling prevails from shipper through the manufacturing process. Each handler should simplify subsequent handling by using handling equipment which is common to all portions of the handling route.

Integration of information and material movement is necessary with suppliers, inspection, purchasing, production control, traffic, packaging, transportation carriers, and even with the sales function. Perhaps the number of times material or information comes to parade rest along the path of movement is an effective indicator of the degree of integration.

There are five primary functions and four associated functions involved in receiving. The primary functions include information reporting, materials handling, layout, personnel and quality control. The associated functions are purchasing, production control, packaging and traffic. All must be considered in an integrated operation.

Integrating Receiving with . . .

1. Information

Within any manufacturing operation, receiving is among the most important sources of information. The receiving information system originates and transmits data on timing, quantity and quality of inbound materials. The difference between success or failure in introducing new office tools such as a large scale data processing computer into a manufacturing operation depends directly upon the accuracy and timeliness of the information generated.

A receiving information system can be guided as to what, when, where and how much data relative to incoming materials is gathered, verified and transmitted. The guiding factors to consider are timeliness, redundancy and exceptions reporting.

Timeliness or age of information is defined as the elapsed time between the arrival of the transport carrier bearing inbound materials and the delivery of information concerning receipt to its destination.

Information transmitted within a receiving system tends to be redundant, due to the fact that much of the basic information already exists within other portions of the manufacturing system. The purchase order, the request for materials, the vendors' invoice and the freight bill, all have a certain amount of common information. The least possible amount of such common information should be reported.

Reporting information from receiving can vary from the reporting of all basic information down to reporting only the exceptions to established rules.

To illustrate, a rule may be established that material is of acceptable quality unless persons involved are informed to the contrary within a certain period of time. This rule would obviate reporting quality conditions on all acceptable material received. Freight charge information and other data can also be subjected to the exceptions reporting rule.

Speeding the flow of information may be done with the aid of various devices including electronic computers.

Electronic Computers—The development and use of electronic computers for processing information in industrial operations may well be the most significant event to occur for the benefit of mankind in the twentieth century. Computational work (such as payroll calculations or the determination of material requirements) and storage of information on magnetic drums, disks, and tape can be accomplished at phenomenal rates of speed.

Office procedures and information handling systems frequently must undergo major change when a new electronic computer is to be used. Whereas the use of a computer brings greater accuracy and speed into the data processing portion of an information system, it also highlights the increased need for more rapid communication within the system. Faster communication is dependent on the ability of the transmitting channel to convey information without its being distorted or delayed en route.

Feeding information into a system using an electronic computer may result in endless confusion if the basic information supplied is either incorrectly reported or misunderstood. Input data must be absolutely correct at the point of origin. Reviews of data accuracy, which are common in manual systems, are not present in systems using electronic computers.

Teletype and Punched Tapes—Punched tapes and teletype machines are being used for reporting information from the receiving area. When receipts are repetitive in nature, the material receiver passes the list to a teletype clerk after verifying the packing list against the physical material. From a tub file, a clerk selects a tape (previously prepared as a byproduct with the purchase order in purchasing) and inserts it into the teletype machine. The operator types in the quantity and depresses an automatic key. The balance of descriptions is automatically typed. All data is transmitted simultaneously to machines in the purchasing office and the data processing center. Typed reports, additional tapes and punched cards are produced here for use in inventory control records.

Telautograph—A Telautograph machine may be used to transmit receiving information to interested functions such as purchasing and production control. Transmission of information relative to material received is achieved within minutes after unloading.

Teletype and Telegram—Teletype machines that are activated by telegrams (tape) from vendors and carriers indicate what has been shipped. Such messages become the receiving reports and are verified against the material when it arrives. At the end of short intervals during the work day, receiving reports the items which have not yet been accounted for so that purchasing may expedite these shipments. Everything else is presumed to have been received. This type of system is operating on the "exception on reporting" basis.

Punched Cards—Use of punched cards for reporting material receipts is spreading rapidly. The punched card is a by-product of the same typing operation which produces the purchase order. Representing purchase orders, the cards provide receiving with advanced information of what to expect. Punched card can be easily reproduced for multiple deliveries.

Visi-Record Cards—These cards, included as a part of the original purchase order set, are now in common use. A single card for each expected receipt is easily maintained in an open Visi-record type file on the receiving floor. With copying machines, copies can be reproduced as required. In this system, multiple receipts are posted to the same receipt record by the material receiver. Then, reproductions are made and distributed, and the receipt record returned to the file for further use. When a delivery is completed, the original receipt is used as one of the copies normally distributed so that it is cleared from the files.

Tags—Some people do not send copies of purchase orders to receiving as advance information and for use as reports. They prefer to issue very simple handwritten tags in multiple copies. Only essential information appears on these tags. Filing systems and other paper work can be completely eliminated.

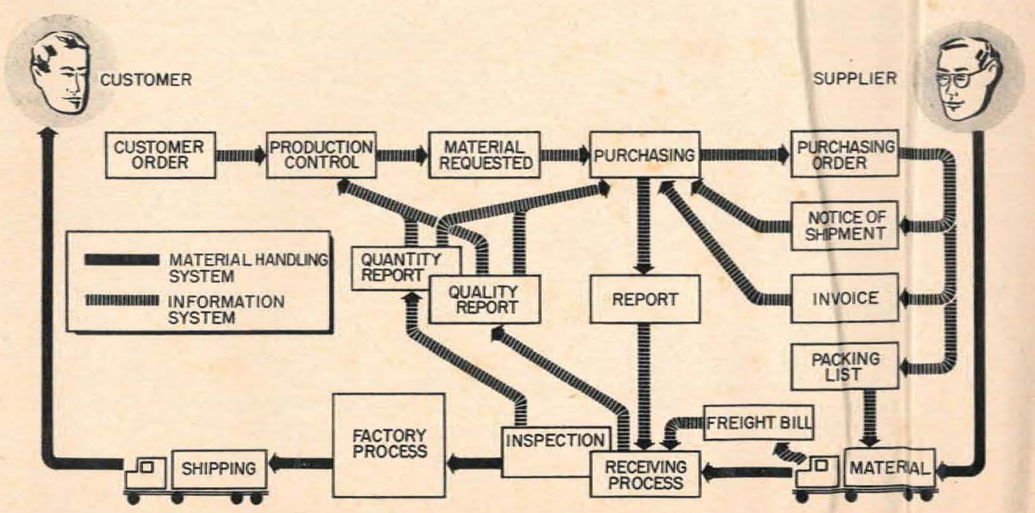
Methods of Analysis—Flow charting permits analysis to be made of each step of the receiving information system. It can lead to cost reductions through elimination of some of the detail steps in purchasing, accounting, traffic or production control as well as in receiving.

The usual flow charting techniques consist of drawing a continuous line, usually in a vertical fashion, to represent the flow of information. Boxes and circles are generally employed to indicate the operations performed.

Physical Layout—The physical arrangement of the receiving area greatly affects the information system. Location of inspection adjacent to the storage area instead of the receiving area can have a major effect. Such a setup would require additional records for both inspection and receiving.

Location of individual work stations in the receiving area may make possible the handling and processing of different freight classifications (trucks, express, parcel post, etc.) using different information systems for each.

A conveniently-located desk on the dock permits one material receiver to sign all delivery receipts while another verifies the material and does the unloading. This may be preferred to having all the material receivers handle both the paperwork and the material.



WHY INTEGRATION IS IMPORTANT—Information and material move between customer, factory and supplier in different patterns. Coordinated receiving considers purchasing, production control, packaging and traffic for a smooth, efficient operation.

Integrating Receiving with . . .

2. Materials Handling

The receiving area is often considered a cost reduction gold mine. To move all materials through it as quickly as possible is the prime goal. There are many ways by which this can be accomplished. However, the effectiveness of any material handling system is only as good as the procedures established to maintain continuous flow.

Mechanizing and standardizing can facilitate continuous flow in receiving just as in manufacturing. However, mechanization can be brought about only by a careful, detailed analysis of present methods and costs.

Continuous movement involves greater use of material handling equipment. It lowers operating costs, reduces confusion and improves inventory control.

Two important steps in the direction of continuous flow are (1) reducing the number of items received, and (2) simplifying and standardizing packaging.

Raw materials and parts incorporated in the products can be simplified and standardized with a consequent reduction in the number of items that must be received. It is this type of simplification and standardization that eliminates handling. While such changes are the responsibility of engineering, the material receiver should point out their possibility wherever possible.

Major reductions in handling costs can be achieved by simplifying and standardizing packages for incoming materials.

The container that serves as both bin and box is an example of standardized packaging. It reduces handling costs, improves housekeeping, and at the same time provides protection for the contents. If these containers can be limited to a few sizes, they can be readily palletized into unit loads. As a result, receiving handling costs decrease radically, accidents decline, and more effective use can be made of handling equipment and space.

There are many areas where cost reduction can be most effective. Here are seven costs which deserve attention:

1. Costs related to the receipt and movement of incoming materials (labor expended for handling and inspecting materials and preparing information relating to each receipt).
2. Floor space charges.
3. Demurrage (the cost resulting from holding the carrier beyond the time allowed for loading and unloading.
4. Packaging costs.
5. Compensation insurance premiums.
6. Housekeeping costs.
7. Losses due to deterioration of receipts.

One way to stimulate thought about improving the handling process is to apply the work simplification test. The test consists of four basic questions. They are:

1. Can operations be eliminated?
2. Can operations be simplified?
3. Can operations be changed in sequence?
4. Can operations be combined?

Handling equipment to be used in receiving will be determined by three important factors. They are:

1. Carrier's vehicle in which the receipt is delivered.
2. Size, weight, number of packages per receipt and the number of receipts in one truck or railroad car.
3. Handling methods employed by stores and the internal transportation system.

Gondola cars and stake trucks—usually used to transport non-perishable or weather-protected sheet, strap, coil, bags, or wire—are unloaded by an overhead crane or hoist or by a fork truck with attachments.

Flat cars and flat-bed trucks—used to transport sheet, strap, coil, bags or wire—can be unloaded by a conventional or specially-equipped fork truck, a walkie forktruck, portable conveyors, overhead equipment or straddle carriers. The latter permits extremely rapid transfer of unit loads from flat-bed trucks to the ground.

Box cars and enclosed trucks—used to transport all types of material—usually are unloaded by mobile devices, portable conveyors, or manual labor.

Specially-equipped unit load cars and trucks—a development of the future—may be unloaded by the conventional or walkie fork truck and by a completely-mechanized conveyor system.

Characteristics of items received have a decided effect upon equipment selection. For example, in three General Electric receiving areas studied, only one package was involved in 60 percent or more of the receipts. At least half of the packages received in two of these areas weighed 50 lb or less. Furthermore, most carriers deliver less than three receipts.

These facts make it difficult to justify mechanized handling equipment seen in so many receiving areas. In this case, it would be simpler to unload packages comprising several receipts onto a four-wheeled truck rather than a pallet! The truck could then be wheeled to the receiver's work station. After the receiving reports were prepared, the truck could be wheeled to a segregation area where the receipts could be unloaded onto pallets for delivery to destinations in the plant.

After the final processing by the receiving system, incoming material could be placed upon a conveyor, pallet or other equipment to be used for movement and storage. A pallet system used by internal transportation should not be extended into the receiving system automatically. Much time is lost by receiving personnel in manipulating pallets, often because there is only one truck available. The money invested in one powered truck will buy many hand units. It is therefore worthwhile to consider hand trucks carefully for this type of operation.

In the minds of many people, receiving implies forktrucks and pallets. This is the case when volume is heavy.

Draglines, in the floor or overhead, can be teamed with four-wheel trucks in some receiving areas. Elsewhere, monorail, and other types of equipment are used.

One General Electric department has a trolley conveyor which will transport aluminum rod in coils from receiving to the point of the first operation. Since the capacity of this conveyor is 100,000 lb, it provides excellent first-in first-out conveyorized raw materials storage.

Chain trolley and related overhead conveyors are not restricted to those applications where heavy loads are handled. They should be considered for moving small items from one operation to another within receiving.

Applications of conventional portable skate, roller and belt conveyors in receiving operations are familiar and do not require detailed discussion.

Integrating Receiving with . . .

3. Layout

A good layout is built around a material handling system. And to a lesser extent, the reverse is true. Therefore, the handling system is a key consideration in every receiving system layout, whether it deals with locations of the receiving docks or layout of the receiving area.

If the receiving system is given the same consideration as the processing area, the flow of materials will be maintained. Whether materials move smoothly or not depends upon the sequence of operations within the system. These should be studied carefully. If a layout is developed around a well-designed materials handling system, based on carefully-analyzed operations, materials will flow. At the same time space will be used effectively.

Rapid flow of incoming material, free from congestion at the unloading dock, depends on an effective arrangement of physical facilities and optimum use of space.

Planning for the optimum use of space is the specific work of a plant layout engineer. However, operating personnel—because of their detailed familiarity with every day situations, ever changing conditions and new ideas—should not be over-looked.

Often, in service functions such as receiving, initial action toward a layout rearrangement is prompted by an operating supervisor questioning or suggesting modifications to an existing layout.

Any consideration of the movement of materials naturally begins with a review of the truck routes between the plant gate and the internal receiving points. Are these routes congested by railroad cars, intra-plant trucks, or stored materials? If they are, then new routes should be considered. Major changes of this sort should not be shrugged off as impossible. The results achieved from such changes are well worth the difficulty in overcoming obstacles.

Flow of inbound carriers is often impeded at the receiving docks by these two conditions described here:

1. Too few truck slips. When this situation exists, the time required for one truck to leave the dock and another to back up to it is great. Time that could be used for unloading is required by truck shifting.

2. Restricted maneuvering space. A typical situation where maneuvering space is restricted exists in one company that uses large quantities of steel. Trucks towing 20-ft or 25-ft trailers must back 100 ft through a 9-ft or 10-ft driveway to get under the unloading crane.

Even though few drivers experience difficulty backing through this driveway, a drive-through receiving dock would reduce set-up time.

Inadequate maneuvering space and a lack of truck slips can be improved simultaneously by saw-tooth docks. This arrangement provides room for more truck docks in the available space and makes spotting easier and quicker.

Dock levelers—whether manual, hydraulic, mechanical or electrical—are widely used for truck unloading. Their efficient use, however, depends on adequate dock width and depth. An unloading area 10 ft wide by 10 ft deep per dock is generally sufficient, if only one piece of mechanized handling equipment is to be operated on the dock. A depth of 15 ft is desirable if additional mobile handling units are to be used.

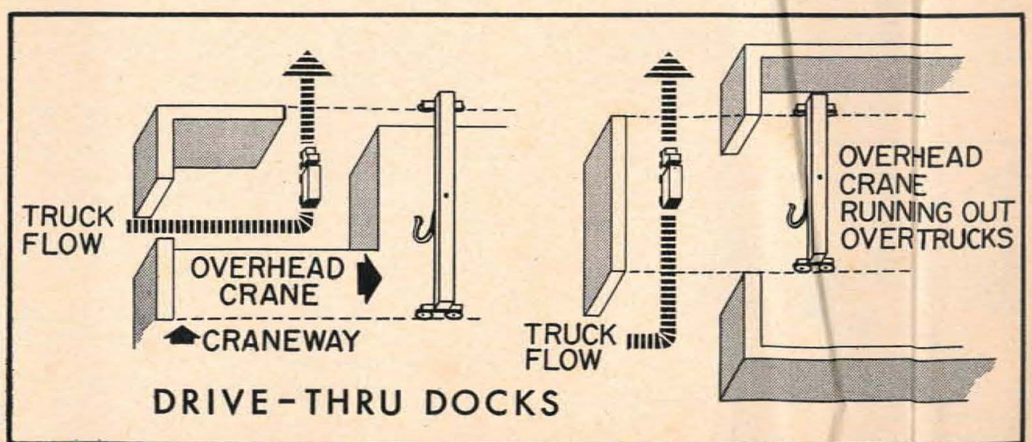
Where outside temperatures drop to uncomfortable levels, truck docks should be sufficiently long so that dock doors can be closed. In some cases, a double door arrangement is used so that the inner door must be closed before the outer door can be opened, and vice versa.

Operation of a single push button sets up the action of the doors. Truck pit length should be based on existing truck regulations (and anticipated changes in them) which vary from state to state.

If an unloading dock runs alongside of a building for a continuous length, it is often wise to mark off specific dock locations about 10 ft wide and number them.

A space utilization check list would contain the following points:

1. Receiving is a processing and not a storage system. For this reason floor space should be small.
2. Space requirements are closely related to the man-



SPEEDING FLOW AT THE DOCK—Even though few drivers may experience difficulty in backing through a driveway, valuable "set-up" time is lost. Drive-thru docks, such as those illustrated here, make truck unloading an easier, quicker operation.

ner in which the receiving system operates. With skip-lot inspection, certification or hold tag routines, quantity receipts never stop in the receiving area. They are moved from truck directly to stock. In this case, the required area depends upon the flow of miscellaneous receipts.

3. For what volume of miscellaneous receipts should space be provided? Compare the cost of each additional unit of space required against the frequency of the requirement and the cost of emergency measures. Space should be provided so long as the former is less than, or equal to, the latter.

A request for additional floor space should be questioned. If the requested space is to be devoted to temporary storage, then see about speeding the flow of materials. One of the axioms of layout states that available space will be used to collect junk—if nothing else.

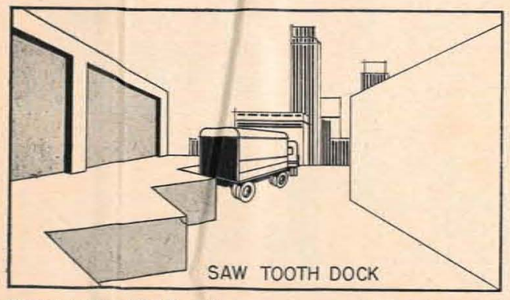
4. If flow cannot be improved, the use of existing space should be studied. Frequently, such a study reveals that available vertical space is not being used. Palletizing receipts and stacking them is then suggested. But palletizing and stacking imply the storage of material in quantity. That is the purpose of storerooms, not the receiving area.

On the other hand, storage racks provide space for pallets on which small receipts can be accumulated, pending delivery by the internal trucking system. A little ingenuity frequently leads to installations involving equipment such as roller conveyors instead of shelves. If the layout encourages loading and unloading the rack from opposite sides, first-in first-out material flow results.

5. Make use of the trucker. Some companies unconsciously accept part of the trucker's job—to the point of actually sending messengers each day to pick up mail and parcel post. Recognizing this, departments are now successfully getting the truckers to do some of the internal transportation job. This is done by establishing receiving points adjacent to eventual storage locations.

6. Several receiving points can help. A separate receiving point—dock or door—for shop supplies and maintenance items is worth considering. In this way, tool crib items can be received without first having to be processed through the production material receiving point.

If the tool crib or stockroom can be located against an outer building wall and have its own dock or door, the stock keeper can then act as receiver. In five cases studied, there were twice as many receipts of shop supplies, maintenance items, and non-durable tools than items of direct production material. This arrangement eliminated double checking and double handling that would otherwise occur at both production receiving and the tool crib.



CUT WAITING TIME—This arrangement is helpful where dock area is limited. It is one way of increasing number of truck "slips," and reduce the time a truck must wait to be unloaded.

Integrating Receiving with . . .

4. Quality Control

Quality products, the responsibility of all company functions, contribute much to the growth of any organization. As competition increases, so will quality requirements. Therefore, current quality assurance practices and techniques may become outmoded. The high costs of maintaining levels of quality will probably increase. For these reasons every phase of quality control—and particularly the control of incoming materials quality—is worth investigating.

The receiving inspection function can be materially reduced without sacrificing material quality. At the same time, the flow of information can be hastened. The purchasing and production functions are assured that quality is acceptable when the "make it right the first time" principle has been applied. When notice of a receipt is also notice of acceptable quality, the typical information lag disappears.

Management can speed the flow of materials and information when it minimizes delays due to misunderstandings and variability in quality measuring devices. Two important steps in quality systems planning are:

1. First, standards and acceptable levels for all quality requirements must be clearly defined. These include appearance and surface uniformity.

2. Inspection and test instructions and procedures (which specify characteristics to be measured and standardize inspection and test methods) must be developed prior to receipt of the first lot.

Only when quality standards and inspection procedures are explained to the vendor can he be expected to understand what is desired. When incoming materials meet quality standards the first time, they will flow smoothly and rapidly through inspection and the entire receiving system. If confidence in the vendor can be developed, certification and auditing can be used.

Frequent checking of gages, fixtures, and inspection equipment, and careful control of their issue, are other phases of inspection management that contribute to the general objective.

Several departments have an incoming material control specialist in their quality control engineering activity. This individual arranges to have the vendor assure product quality wherever possible. He usually works in cooperation with design engineering, manufacturing engineering, purchasing, shop operations and receiving inspection.

Three changes in quality control methods will promote the flow of materials and information at most receiving installations:

1. Burden of quality proof can be put upon the vendor.
2. Revision of inspection and test methods can release quality information faster.
3. Receipt-processing equipment can be improved.

When the burden of proof of incoming material quality is placed on the vendor, materials move through the receiving system more rapidly and at less cost.

Responsibility for quality assurance can be transferred only to qualified vendors, and then only in varying degrees after quality performance has been proven. For example, maximum responsibility for proof of quality may be given a vendor. He is then permitted to use vendor certification.

This vendor sends with the incoming material copies of his quality control records, test data, and test samples, as statement of compliance with company specifications. Inspection is reduced to checking certificates of quality—an operation that can be combined with verification of the packing slip and auditing. Incoming materials flow on.

The privilege of certifying receipts is extended only after a close check of the vendor. His organization, processes and equipment used to produce and maintain desired quality levels must be appraised by quality control, purchasing, design and manufacturing engineering. His performance must warrant granting certification.

Skip-lot inspection plans (plans which require inspection of every fifth, tenth or eleventh receipt, statistical sampling techniques, etc.) may be used to assure quality of certain incoming materials prior to granting of certification. Such plans transfer partial responsibility for quality assurance to the vendor.

Material and information also flows more rapidly if pre-production samples are inspected. Unacceptable characteristics of the incoming material can then be corrected before the vendor runs production lots. If sample castings and weldments, for example, are checked carefully for conformance to specifications, production run lots may be more rapidly placed on auditing inspection.

All of these devices transfer the responsibility for proving conformance with quality levels to qualified vendors. They do not lower the quality of receipts. Instead they speed the flow of materials and information.

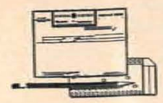
Confidence in these devices is based on the proven ability of your vendors as reliable, stable suppliers—who recognize the importance of quality to your company. Purchasing buys quality as well as price. Why should your company duplicate the vendor's efforts when you have proven that you can have confidence in them?

Records of vendor quality performance and trends indicated in these records help assure the receipt of good materials, and help to warn the vendor when trouble is imminent. The data and appraisals, formalized into a quality rating plan, assist purchasing in selecting vendors who can produce quality materials.

Incoming material inspection is necessary when a specific item is purchased infrequently from the same vendor, when first lots are received from a new vendor or from a new process, or when an established vendor's quality has gone out of control. Flow of these receipts through the inspection area can be improved in two ways:

1. Effective management of receiving inspection.
2. Coordination of inspection with other components of the receiving system.

Do all receipts require the same degree of verification? No! It is a waste of time and money to verify the receipt of five wrenches costing 50 cents each, using the same procedure as you would to verify the receipt of five meters worth $50 each. Similarly, it makes little sense to verify the quantities of low-value items stocked in large quantities with the same care used to check incoming lots of other items for which inventories are maintained at a hand-to-mouth level. Judgment plays an important role here.



Integrating Receiving with . . .

5. Purchasing

Purchasing is often so busy placing business with its numerous vendors, and then expediting delivery that it may on occasion overlook (and seemingly neglect) its equally important responsibilities. These include shepherding goods onto stockroom shelves or into accumulation areas in adequate number and with the assurance of proper quality. Only then is the purchasing cycle completed.

Purchasing controls receiving's master working instructions—as represented by incoming documentation accompanying material received, or by receiving's copy of the purchase order. Therefore, purchasing must assume the burden of proof when packages are misdirected or delivery instructions are poor.

Purchasing is the communication medium between supplier and receiving dock, and must make an accounting whenever it breaks down. As the negotiation body for a department, purchasing may make decisions and inject special considerations which affect the normal operation of a receiving area.

The purchasing—receiving courtship is not a one way romance. Receiving has the obligation of getting receiving information to purchasing for quick invoice approval so it can proceed to accounting. Well-paid, happy suppliers are the ones who are easiest to persuade that packages should be legibly marked, delivered at a certain time or that vendor lab certification should become part of the shipment procedure.

Receiving personnel should always be on the alert to report inconsistencies in incoming deliveries. Many a transportation problem has been licked or improved by an alert worker on the dock.

Since purchasing and receiving must work closely together and are often located remotely from each other, communication is most critical.

In some locations, the conventional "squawkbox" or Telautograph furnish the communication necessary without tying up phone lines. One General Electric receiving area uses a Bell System Transmitter with by-product tapes. Some day closed-circuit television will be used.

Three Tips on Integrating Inspection-Receiving

1. Integrate receiving inspection data with that of other components of the receiving system for automated data handling.

2. Combine inspection and receiving system clerical activities when vendor certification is employed.

3. Use receiving inspection for troubleshooting and corrective action to obtain prompt disposition of substandard material and maintain continuous flow of quality material.

But whatever the problem in this area, nothing beats a purchasing agent's unplanned walk through the receiving area on occasion, and a receiving supervisor's return visit to purchasing to review a troublesome situation. Manufacturing plants with this kind of understanding and teamwork can avoid the problems that cannot be worked out quickly and efficiently.

Both groups must be careful to have a thorough understanding of each job and responsibility, and take the initiative to review current problems and solve them before they have been repeated.

The document most influencing receiving is the purchase order. Special shipping instructions may be recorded that take much of the guess-work out of getting a package to its proper destination.

For example, reference on the body of the order to a name that inquiries may be directed to—other than that of the buyer or material clerk—will save time and duplication of effort. Address instructions, particularly in multi-plant work, are very important. They should be marked plain and big, so that anyone can quickly determine internal destination and make rapid delivery.

In special cases where no orders are placed because of special arrangements with vendors (whereby continuing partial deliveries are allowed), standing orders with special controls should be initiated. Local truck pickups of small purchases from nearby vendors should be cleared through receiving to avoid buildup of uncompleted orders.

Re-designed purchase orders have resulted in many cases where receiving papers fail to work satisfactorily. New forms should allow easy manual posting of information, particularly for partial shipments. One General Electric organization keeps only one receiving report for each order, then makes up and sends out as many copies as it needs for distribution on a small reproducing machine. On partial shipments, each succeeding copy mailed supercedes the prior copy and carries the up-to-date story on the order.

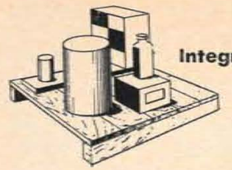
Combining small lot requests not only saves purchase orders, but cuts down the number of packages coming into an unloading area.

One way of handling repetitive supplies activity is to place open orders with reliable local dealers, covering a specific period of time and with delivery direct to the requesting individual. Receipt documents are prepared, accumulated and billed monthly by the vendor.

Many continuous production operations have important suppliers who deliver material on an hourly basis throughout the day. Such tight scheduling of deliveries is characteristic of departments having product-type layouts, particularly when the material amounts to a considerable portion of in-process inventories.

Possibilities of negotiating more precise delivery schedules can be exploited with all major or critical suppliers, where specific hour or day deliveries will be beneficial. This will be true where material can be phased into the daily operation at point of use, or when an item is difficult to unload.

For example, consider the problem posed by a two-day delivery of a new, delicate machine tool that catches everyone unaware because millwrights and other special unloading crews have not been advised. The carrier may be tied up at the unloading dock for hours until the special crew has been notified.



Integrating Receiving with . . .

6. Packaging

Most incoming materials are received packaged in one form or another. Generally, the packaging cost is included in the vendor's price and receives little or no attention. Similarly, methods and costs of handling receipts are often overlooked.

Incoming material, therefore, should be watched to see if the packaging can be improved from the standpoint of protection and handling ease, or if the number of packages received is sufficient to justify palletization. A watchful eye on incoming deliveries will soon turn up obvious difficulties—such as the frequent delivery, by one or two carriers, of damaged material.

If a vendor's deliveries are consistently received in damaged condition (and not as the result of mishandling), purchasing should be asked to have a representative of the vendor inspect the damaged delivery and to devise an improved package. A packaging specialist or planner should be invited to aid in the development of a better package.

If the damaged goods are inter-works shipments, the packaging specialists should be asked to handle the problem through purchasing directly with the supplier department.

The information gathered by the material receiver will aid the packaging specialist, whether he is employed by the company or by an outside vendor. An observant material receiver can supply the packaging specialists and purchasing personnel with the facts about his problems by asking a few simple questions:

1. Is this material over-packaged?
2. Is it under-packaged?
3. Can the package be handled easily?
4. Should packages be received in palletized form?

These questions may lead to some interesting answers and substantial cost reductions.

The packaging specialist will welcome pictures of any damaged containers, particularly if they are taken in the carrier's vehicle as unloading progresses. If that is not possible, make sketches showing the arrangement of the load and the location of damaged packages. Note variation in damage with the position of the package in the load. Actual container dimensions and weight of contents as well as those indicated by the boxmaker's certificate, will be particularly helpful in the event material is received in a corrugated container.

A valuable tool of any receiving operation is the instantaneous picture-type camera. A snapshot is worth its cost many times over. It can be used to record before and after sequences, and is very helpful in promoting package improvement.

Personal contact with outside vendors and other operating components, through purchasing personnel, is the key to improved packaging of receipts. Letters and telephone calls will not initiate such a problem satisfactorily, because neither party is aware of the other's aims and needs. Usually the recipient is not familiar with the packaging equipment operated by the vendor company.

Packaging and materials handling engineers play a large part in this improvement. They will consider protection of the products, shipping classification requirements, fit of contents, handling in production, available packaging equipment, and other important factors.

Engineers must also, as far as possible, size the container to fit one of the standard pallet patterns. Obviously, size is limited by the nature of the contents, but full use of the pallet surface and stacking height can often be gained by juggling container size or the arrangement of packages on the pallet.

Incoming materials may be over-protected. The receiver should compare packages in which similar materials are received and note their condition on arrival. From these comparisons, he can ascertain whether a receipt is over-packed with respect to its weight.

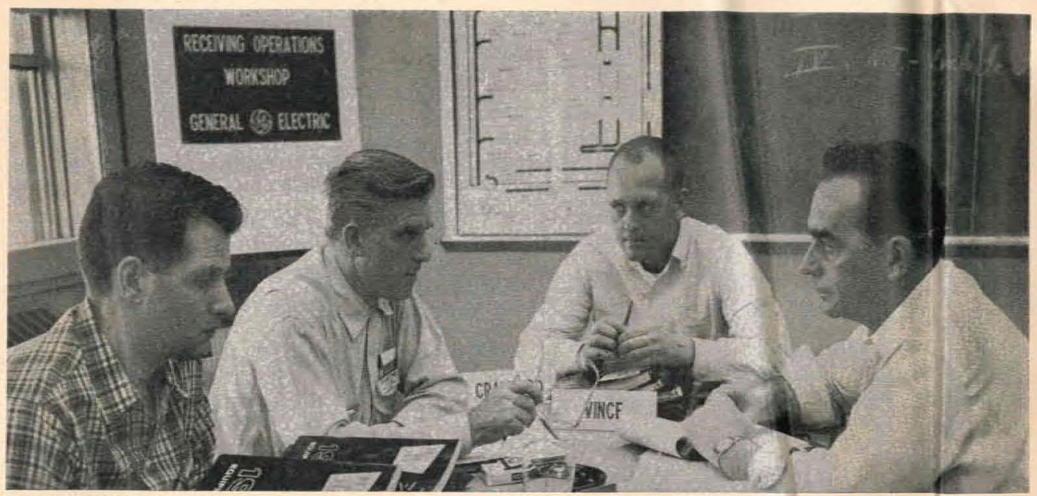
Either over or under-packing warrant review by a packaging specialist. Over-packing adds the excess cost of the container to the cost of the product, just as under-packing with consequent package failure adds to the cost of rework, excess handling, or production delays.

Product damage or excessive container costs can be reduced by the vendor through laboratory pre-shipment tests (compression, impact and vibration) of improved containers. These tests abuse the packages products under controlled conditions to ascertain ability to withstand the hazards of transportation. The tests include both under-packing and over-packing, and show where less expensive materials can be substituted. Results are usually confirmed by trial shipment.

One of the major points to consider in connection with incoming packaged materials is the impossibility of separating packaging from handling. Packaging and handling operations are so closely related that they must be studied at the same time.

Any changes in packaging or handling methods should consider all packaging materials and practices, related handling methods. This means consideration should be given to loading and shipping, storage and distribution

How General Electric puts its receiving operation information to work



THE WORKSHOP encourages group discussions of mutual problems. By exchanging ideas, students learn how to use information to best advantage. Here, one group tackles its assignment, a case history to be worked out in class tomorrow.

General Electric's internal education program concerned with making improvements in the receiving area centers around a three-day workshop. Held on the campus of Cornell University, these workshops have enabled the company to present valuable operating information to more than 80 of its key receiving personnel. Selected by Managers-Manufacturing, workshop students represent General Electric installations from all over the U.S.

The text used in workshop sessions in GE's *Receiving Operations Guide*. It is the same text which was used as a basis for this article. Case history material and worksheets supplement the text.

Workshop instructors are members of the university's teaching staff. Personnel from GE's production control group also take part. They show students how to apply, via the case history method, what they have learned from the *Guide*, classroom and discussion groups.

Dollar savings are only one way GE measures the results of its receiving workshops. There are numerous intangibles such as improved layouts and better paperwork to be considered when reviewing workshop advantages.

AT CORNELL, workshop student can clear his mind of daily routine and concentrate on work at hand.

techniques, and the cost of all of these activities.

Palletization for internal and external handling of packaged products, when volume permits, is a growing trend. Many manufacturers and producers are finding that economies offered by palletization aid in meeting rising labor costs and intensified competition. In addition to reducing labor costs, economies of palletization include:

1. Optimum use of storage capacity and transportation space.
2. Reduced damage and freight costs.
3. Expeditious handling and delivery of the product.

Careful selection and construction of pallets is essential if the full economies of palletization are to be realized. Patient work, study, and salesmanship are required to get an outside supplier's palletization program underway. The results are well worth the effort expended.

Sometimes the packaging specialists can effect extra economies by using heavier than required board, which gives a container the stacking strength necessary to permit high tiering of pallets. The increased storage space more than offsets the increased costs of packaging materials. This is particularly true where the contents do not offer any support to the container.

Knotty problems involved in repeated and awkward handling of small parts can be sharply reduced by a bin-type packaging unit used at one GE installation. It is a special shipping, storing, and dispensing container for small hardware, plastic, or metal parts. The pack is constructed of corrugated board with a sleeve running through its entire length. Scoop ends pull out a limited distance on both ends. Covering flaps, when taped, seal ends of the box.

The container's most obvious advantage is that it cuts down the materials handling from receiving area or stockroom to work station, since the small parts remain in the original shipping container until actually used up.

Because of uniformity and ease of stacking, these units can be palletized efficiently. They can be moved from receiving to work station in one continuous flow, thus averting production line hold-ups. If careful handling is involved, they are often reusable.

Seven Rules for Constant Flow

1. Receiving is a processing area—not a storage area! Material should flow rapidly; it should be kept off the floor.

2. Except for emergencies, material should first be processed through receiving.

3. Common carriers should be unloaded with the least effort, in the least time.

4. Unsafe manual material handling should be reduced to a minimum.

5. The handling system should be sufficiently flexible to accommodate variations in size, weight, and other characteristics of materials.

6. Manpower, equipment and space should be utilized to their maximum effectiveness.

7. Information regarding receipt should flow as fast, or faster, than the material itself!

Integrating Receiving with . . .

7. Personnel

Staffing the receiving operation poses a number of special problems since the operation is normally faced with a fluctuating load. Many sections maintain material receivers to handle the minimum load and rely on related functions like stockkeeping and maintenance to meet peak volumes. The reverse also works; i.e., staff to meet peak loads, then release men for other worthwhile manufacturing assignments during idle periods.

As in any other function, receiving sections operate best when well-planned, forward thinking personnel practices are in effect. For each job an explicit title job description is necessary outlining the range of responsibilities and wage payment and progression plan. Promising men are often rotated into other functions and outstanding performance is rewarded by promotion.

Proper motivation of receiving employees is important since units are remotely located from other manufacturing groups. An understanding of receiving's importance to the manufacturing process and how each individual in it can contribute to the profit of the business through cost reductions and improved service will make the receiver aware that he belongs on the team.

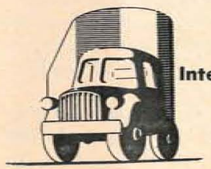
Too often in a service function employees do not feel this sense of belonging and have been left out of the direct channel of communication. There are a number of ways employees can be made aware of the importance of receiving.

Specialized courses covering subjects like workplace layout, materials handling equipment, work simplification and analysis offered to receiving specialists and supervisors will pay handsome dividends in job satisfaction as well as dollar savings in costs. In a recent series of workshops conducted at Cornell University for 80 General Electric receiving personnel, these very subjects were presented in the three-day program. The cost of preparing material and presenting the program will be recouped many times in direct, measurable cost reduction accomplished after the conferees returned home with a new attitude and set of tools to analyze and improve their operations. Training can also be accomplished by a simpler, less expensive method: self-education. On the job sessions drawing from talent in related functions is an effective way of broadening an individual's knowledge and interest in his work.

Special studies or analyses of work volumes and flow patterns can be planned and executed in the receiving operation or by bringing in students who are part of a formalized company training program. Of course, if one or more persons from the receiving unit can adequately perform the analysis, the sense of accomplishment will be greater. This kind of assignment need not be confined to just systems analysis. For example, in conjunction with plant safety engineers, it could be the designing of a comprehensive safety program for receiving personnel.

Successful personnel planning is not difficult in the receiving area, but such standard practices as hiring just anybody for the job and then doing little to train them is to be avoided. Recruiting promotable people, developing positive attitudes and good morale through special assignments, training and rotation will prevent stagnation and form the basis of an effective service operation.

While the number of personnel may vary from one receiving operation to another, the duties of individuals, such as unloading trucks, are remarkably similar.



Integrating Receiving with . . .

8. Traffic

Many plants, built prior to World War II, were equipped for rail deliveries. Large plants operated their own switching locomotives. Regulation of trucks by the Interstate Commerce Commission, under the Motor Carrier Act of 1935, focused greater attention on truck transportation and started a trend toward diverting inter-city tonnages from railroads to trucks. The trend has continued to the extent that many plants are now wholly dependent on truck transportation.

New plant designs take into account the shift in type of incoming carriers, and generally have provided adequate truck facilities for normal production requirements. However, older plants often suffer from lack of adequate truck docks and from truck bays of insufficient depth to accommodate the longer trailers. Unused rail-sidings inside buildings have been covered to satisfy manufacturing space demands, thus diminishing receiving facilities.

Nevertheless, with all its handicaps, the receiving function can be made to operate smoothly through the contributions of traffic and other technical functions.

Traffic control can be aided by putting the purchase order to work. Before a purchase order is placed, the buyer should consider freight rates and the weight classification of the item to be purchased. If a copy of the purchase order is to be made available to the receiving unit, it should show the freight classification. It is then convenient for the material receiver to check the classification against that shown on the transportation receipt furnished by the delivering carrier. This check can be a source of considerable savings in transportation costs.

The problem of congested platforms and excessive truck detentions has been handled with considerable success by instructing truck lines to make deliveries throughout the day. This was not possible a few years ago when it was the usual practice to make deliveries in the morning and pickups in the afternoon with the same equipment. Now, with more equipment and greater competition, it is possible to set up a planned receiving schedule.

Number of trucks entering the plant can be controlled by stipulating the name of the carrier on the purchase order. Orders placed with vendors located in a common trucking area can be accumulated by prior arrangement, in a given carrier's terminal from which all material is routed via a single truck line. Thus the number of trucks entering the plant can be reduced considerably. Lower transportation cost is an added benefit.

Every receiving operation is faced with the problem of damaged material and shortages of items listed in deliveries. It is important that all irregularities in a shipment be recorded on the carrier's delivery receipts. When damaged goods are delivered, carriers should be notified promptly and requested to inspect the damage. Prompt action will not only protect the filing of a claim, but will also strengthen the case for collection of damages. Likelihood of early payment is increased.

The receiving unit is generally involved in the payment of transportation bills. In this connection, it is important to understand Interstate Commerce Commission's requirements for the payment of these bills.

Rail Freight—Under a credit arrangement which usually exists in operating departments, rail freight bills must be paid within 96 hours calculated as follows:

When the freight bill is presented prior to, or at the time of delivery of freight, the 96 hours of credit shall run from the first midnight following delivery of freight.

When the freight bill is presented subsequent to delivery of the freight, the 96 hours of credit shall run from the first midnight following presentation of the bill.

Rail carriers should present or mail freight bills not later than the first midnight following delivery of the freight, except when rate information is not available to the carrier, in which case the freight bill should be presented as soon as possible. When freight bills are mailed, the time of mailing shall be deemed the time of presentation of the bills. In case of dispute as to the time of mailing, the postmark is accepted.

Truck Freight—For truck carriers, the Interstate Commerce Commission has authorized a seven-day period for presentation of bills following delivery of freight and a like credit period for payment. The same regulations are prescribed for the presentation and payment of freight-forwarded bills.

Water Freight—Payment of charges to water carriers is on the same basis as rail carrier regulations, except that presentation of freight bills should be made prior to the second midnight following delivery of freight.

Truck Detention Charges* Apply Above These Free Times—An Example

Material, lb.	Free Time, min. Per Vehicle
2,000 or less	40
Over 2.000 but not over 6.000	60
Over 6.000 but not over 12.000	120
Over 12.000 but not over 18,000	165
Over 18,000 but not over 24.000	210
Over 24,000 but not over 30.000	255
Over 30,000 but not over 36.000	285
Over 36,000 but not over 42.000	315
Over 42,000 but not over 48.000	345
Over 48.000 but not over 54.000	375
Over 54.000 but not over 60,000	405
Over 60,000	435

* Charges for detaining a truck beyond the free time allowed will vary upward from $2.50 per half-hour.

Many companies specify "FOB—Delivery Point," "Price to Include Delivery Charges" or "Freight to be Prepaid" on their purchase orders.

Bulk commodity deliveries such as steel are generally made subject to collect transportation charges with the company making payment as indicated above, according to mode of transportation used.

There are penalties, of course, if rail and truck deliveries are not unloaded promptly. Almost everyone is familiar with demurrage penalties for detention of rail cars. The Association of American Railroads recently ordered a change in demurrage rules, to increase the cost of detention of cars for loading and unloading.

An extensive investigation into the need for changing demurrage rules is being conducted by the Interstate Commerce Commission. Present rules will prevail until a decision is reached by the commission.

Charges for detaining a truck beyond the free time allowed will vary upward from $2.50 per half-hour. If delivery is offered during normal hours and not made, necessitating re-delivery, a charge is made in addition to the accrued freight charges.

One plant estimated that truck detention charges could amount to $30,000 per year. This illustrates the expense which can be incurred if positive action in speeding up the unloading operation is not taken.

The expansive subject of freight tariffs encompasses geographical locations of shipping and destination points, weight and commodity classifications, and Interstate Commerce Commission and state regulations. The receiving foreman should review freight tariffs with the traffic specialist of his company. Periodically, an incoming material traffic study may be made by the traffic specialist. The receiving foreman should review these studies.

Integrating Receiving with . . .

9. Production Control

The Production Control function is primarily responsible for assigning materials to the processing lines in accordance with a detailed manufacturing schedule. Consequently, the production man is both directly and vitally interested in the relative efficiency and activity of one receiving unit. The receiving information system furnishes, in many cases, the input information to the production control operation, and therefore impacts on the accuracy and timeliness of material control records. In a batch or flow business, the rapid transfer of goods to processing lines is of paramount concern.

The job shop, however, usually takes the materials from receiving to the stockroom or accumulation area. In this instance, timing and material movement is not as important as the communication or information media. Accurate counts, correct identifications and simplified documentation by receiving are all important to the stockkeeper's better management of his inventory responsibility. Sensitivity to rush orders by the receiver also contributes to the production man's well being.

Receiving must always be concious of the fact that its function starts the entire manufacturing cycle and markedly affects the material and inventory control system. A good plan keeps material flowing to production.

Next Month: Part II of How to Plan Receiving Operations—Analyzing Receiving Operations and Measuring Receiving Performance

---

These are the men who worked with MMH to make this report possible

C. WILLARD BRYANT
GE Manager-Materials
Manufacturing Service Div.

H. FORD DICKIE
GE Manager
Production Control Service

E. C. THRONDSEN
GE Consultant
Production Control Service

JOHN R. HUFFMAN
Professor
University of California

The editors of Modern Materials Handling *are indebted to General Electric Company for its cooperation in making available text material used at the Receiving Operation Workshops conducted at Cornell University for company personnel. The prime reference source is GE's* Receiving Operation Guide *organized, directed and edited by E. C. Throndsen, Production Control Service. Much of the material on measuring and improving receiving performance was contributed by John R. Huffman, University of California at Los Angeles. Too often the contributions made by the men who formulate the long-range plans and encourage project work of this nature are overlooked. MMH would like to point out that the conception of this project should be credited to H. Ford Dickie, Manager, Production Control, and to C. Willard Bryant, Manager-Materials, Manufacturing Services Div., without whose cooperation, foresight and understanding of the problem, this special receiving report would not have been possible.*

Reprinted from MODERN MATERIALS HANDLING, September 1957

SPECIAL Modern Materials Handling REPORT

How to Plan Receiving Operations

Part 2 — Analyzing and Measuring

This is the second part of a complete report on how to obtain an efficient receiving operation. Integrating receiving with other functions, covered in Part I, set the stage for analysis and measurement. Here are proven methods to help you analyze your own operation, make improvements and measure performance. It offers several sure-fire ways of providing a faster, more economical receiving service, based on General Electric Company's Receiving Operation Guide.

Variety may be the spice of life to some people, but to the supervisor or foreman of a receiving operation variety is a problem. Some inbound transportation carriers arrive at completely unpredictable hours. Others always arrive at approximately the same hour, but the exact arrival time varies from day to day. The number of receipts varies and physical characteristics of packages that arrive in the receiving dock vary tremendously.

As a result, manpower and material handling equipment requirements fluctuate from hour to hour and day to day. Yet, in spite of the variability problem, receiving operations can be planned to yield superior performance. Any intelligent planning, however, must be preceded by an analysis of incoming material.

Analyzing Incoming Material

One way to obtain an orderly picture of incoming material is to make an analysis of the distribution of receipt weights, an analysis of container characteristics, or an analysis of the variabilities in weights and number of packages per receipt.

Each of these distributions portrays a part of the receiving load. After categories have been established and analyses made, the problem becomes more recognizable. Since definition is the first step toward improvement, rapid progress usually follows analytical distributions.

Of course, it is always easy to say "My receiving operation varies too greatly to be analyzed." But in saying this, you disregard an important opportunity for improvement.

Averages do not present the receiving picture in true perspective and can be misleading. For example, although the average receipt in a typical GE operation was 4000 lb, 22 percent of the incoming lots weighed less than 5 lb, and 52 percent weighed less than an easily-handled 50 lb, and 78 percent weighed less than the average. The few 20,000 to 30,000-lb receipts and lone 100,000-lb item distorted the average until it had little useful meaning.

A breakdown, called a distribution of receipt weights, can be made from tabulations of receipts per order, pieces per receipt, and receipts per delivering carrier. It takes such distributions to present the receiving picture in its true perspective.

Methods studies, using analysis such as this have led to significant cost reductions. There are seven elements of information required to complete an analysis of receipt characteristics. They are:

1. Number of receipts delivered by each carrier.
2. Number of receipts required to complete an order.
3. Number of pieces in each receipt and type of packaging.
4. Weight of each receipt.
5. Destination within the plant.
6. Dollar value of each receipt.
7. Unloading time and method required.

Analysis of Receipts Indicates Most Economical Handling Method

Receipt Weight \ Number of Packages	1	2	3	4	5	6-10	11-25	25-50	50-100	100-200	200-300	more than 300	total receipts
Less than 25 lbs.	34	1				2							37
26 to 50 lbs.	2	3			(B)	2							7
51 to 100 lbs.	6	(A)	1	1									8
101 to 500 lbs.	2	5	1	2	2	2	1						15
501 to 1000 lbs.	2	1	4	2	1	2	1		1				14
1001 to 5000 lbs.		1	4			1	3	3					12
5001 to 10,000 lbs.											1		1
10,000 to 15,000 lbs.													
15,000 to 20,000 lbs.													
20,000 to 25,000 lbs.							1*						
25,000 to 30,000 lbs.													
30,000 to 35,000 lbs.													
35,000 to 40,000 lbs.													
40,000 to 50,000 lbs.							2*						
Total Receipts	46	11	10	5	3	9	8						

Key to Charts (G.E. Criteria)

Area A—Receipts weigh less than 500 lb per package—handle manually with lifting aids such as hoists.

Area B—Receipts weigh less than 75 lb per package—handle manually with 2-wheel or 4-wheel hand truck.

Area C—Receipts weigh more than 500 lb per package—handle with powered floor equipment.

* Asterisk denotes unit loads

EXAMPLE A—There are 10 receipts in area **B** and 10 in area **C** that are not unit loads. These figures indicate that this department should try to sell vendors on fewer but heavier packages and convince them to ship in unit loads if possible.

Receipt Weight \ Number of packages	1	2	3	4	5	6-10	11-25	26-50	50-100	100-200	200-300	more than 300	Total Receipts
Less than 25 lbs.	37												37
26 to 50 lbs.	6				1	(B)							7
51-100 lbs.	5	4		1									10
101 to 500 lbs.	4	2	(A)			2							8
501 to 1000 lbs.		1	1		1	1							4
1001 to 5000 lbs.		1		1	1		3	3					9
5001 to 10,000 lbs.				1						2			3
10,000 to 15,000 lbs.										(C)			
15,000 to 20,000 lbs.								1					1
20,000 to 25,000 lbs.											1		1
25,000 to 30,000 lbs.						1*				3			4
30,000 to 35,000 lbs.												2	2
100,000							1*						1
Total Receipts	52	8	1	3	3	4	4	4		5	1	2	87

EXAMPLE B—The pattern of entries toward the bottom and to the right of the chart indicates that this department must handle heavy loads and a large number of packages per receipt. This may be done by palletizing or conveying direct to stock.

Most economical handling methods can be planned and packaging can be coordinated by analyzing variabilities in receipt weights and packages per receipt. Examples of how to use this technique are given in the distribution of these two variables for operations using two-wheel or four-wheel hand trucks and walkie or rider-type fork trucks (see analysis chart on opposite page).

Regions on the charts may be established arbitrarily and can be modified after an analysis of the costs of handling have been made. Two limitations were established in setting up the regions on the charts. One of these limitations is the number of packages per receipt, and the other is the weight per package.

In region A packages weigh less than 500 lb each and the number of packages range from 1 to 25 per receipt. In region B packages weigh less than 100 lb and number from 2 to 25 per receipt. All of the receipts that weigh more than 500 lb regardless of the number of units per receipt are found in area C.

Another way of expressing this, which presents the reasons for setting up the regions, might be:

Receipts within the area marked *A* weigh less than 500 lb per package (package in both of these departments are usually uniform in weight) and the number range from 1 to 25. Such receipts can and should be handled manually with lifting aids such as hoists or monorails.

Receipts that fall in chart area *B* weigh less than 75 lb per package and consist of from 2 to 25 packages. These are usually handled manually or with the aid of a 2-wheel or 4-wheel hand truck. To reduce handling costs, vendors should be asked to package these in fewer, larger containers.

All of the receipts that weigh more than 500 lb, regardless of the number of units per receipt, are found in area *C*. These should be handled by walkie or rider-type fork lift trucks, since such incoming material should be palletized or skidded.

Modified charts, such as shown on opposite page, can be used as a guide to handling methods. The charts should be posted in the receiving area where material handlers have an opportunity to familiarize themselves with them.

Analyzing Move Times, Delays and Volumes

Many supervisors make it a practice of noting—particularly when walking into the work area unexpectedly—what each employee is doing.

Such observations may lead a supervisor to conclude that "Pete Smith works consistently," but "Joe Jones seems to dog it," and "Al Adams can't be doing much work because he is always in motion." These observations help to form the supervisor's evaluation of the operating activity.

Many supervisors are hesitant to discuss conclusions based solely on snap observations with an employee. The supervisor has no facts—only impressions. Without knowing it, he may have selected observation times at hours that coincide with Joe's rest periods, or Al's necessary trips to the files.

Time studies covering a day's activity provide correct information and reduce uncertainty, but such studies are costly. Furthermore, Joe may work steadily while the time study is in progress.

The answer to what should be done is straightforward. The foreman should continue his observations, but make them at the intervals and in the manner specified by recognized work sampling techniques.

His conclusions will then be in measurable terms: "Joe Jones was observed 500 random times and found idle 50 percent of the time. We can be 95 percent sure he is idle between 45 and 55 percent of the time." Since the 500 observations were taken at random, they are representative of Joe Jones' entire work day.

Now the supervisor is prepared to deal with Joe because he has facts and can substantiate his statements with results of other similar studies. The facts were obtained by a modernized extension of the same "snap observation" technique which had been used intuitively.

Work sampling indicates not only idle time but also man-hours required for unloading trucks, verifying papers, inspecting, etc. With ingenuity, performance standards can be established for such jobs.

Work sampling will determine the percentage of time employees spend at different tasks if each job duty is coded and the appropriate code letter recorded. For example, *M*-1 might indicate manual unloading or handling, *M*-2 operating a powered truck, *T* talking etc.

At each random observation time, the supervisor decides instantaneously what each employee is doing and notes the proper letter. When the study is finished, the percentage of time devoted to each task is calculated.

Measures of labor performance and the allocation of time-to-job duties can be established simultaneously if observations are repeated at random intervals throughout a selected time period, such as a full working day. Such observations taken in one department provided the following breakdown of the activities of five men:

	Percent
Verifying papers and preparing receiving reports	11
Handling receipts manually	21
Handling receipts mechanically	21
Idle*	20
Absent from receiving area (chiefly employee *C* who delivered receipts to the storeroom)	15
Supervision	5
Talking on phone	2
Walking or delayed	5
	100

*The study period was not sufficiently long to determine if the 20 percent idleness was justified by truck arrival and unloading rates.

But even more interesting observations were made about individuals. For example, the checker, whose workload was supposedly excessive, was found to be idle 25 percent of the time. He was idle more than were employees *A*, *B*, and *C*, who handled 50 to 100-lb packages quite consistently.

The checker and the group leader seldom assisted the other men in unloading trucks—even when trucks waited for more than an hour.

There are many other uses of work sampling such as checks on equipment and space usage.

Checking Dock Capacity

Between the arrival of a carrier at the plant gate and the delivery of incoming material to point of use or storage, elapsed time may be hours or days.

For most receipts, unloading takes less than one hour. Verification of vendor's packing slips and preparation of receiving reports requires less than 15 minutes, and inspection takes less than an hour. Transportation to the point of storage or use is usually accomplished in a few minutes.

What takes all the time? Waiting! Waiting for the carrier to be unloaded. Waiting for verification of packing slip and preparation of receiving reports. Waiting again for inspection. And finally waiting for internal transportation. Waiting time goes up and down with the rate of material arrival.

What can be done? The work force can be planned for each operation in the receiving system, following queueing or waiting-line theory. Queueing theory takes into account the variation in arrival of material and the variability of processing facilities.

It is clear that a line of trucks will lengthen as the average time to unload a truck becomes greater than the average interval between truck arrivals. For example, a line will form and grow if trucks arrive at an average of 15 minutes apart and unloading requires 20 minutes.

If, on the other hand, additional personnel reduces unloading time to 15, 10, or 5 minutes per vehicle, a shorter line—but still a line—will develop at intervals because:

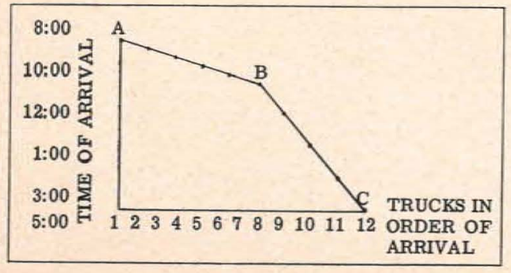
1. While trucks arrive 15 minutes apart on the average, individual trucks arrive at varying intervals.

2. Although unloading of a truck requires an average of 5 (or 10) minutes, unloading of any one truck usually requires more or less than the average.

TRUCK ARRIVAL DATA

Time between arrivals	Number of trucks
2 min. or less (1 min. avg.)	1
2 to 4 min. (3 min. avg.)	0
4 to 6 min. (5 min. avg.)	0
6 to 8 min. (7 min. avg.)	5
8 to 10 min. (9 min. avg.)	10

If trucks seem to arrive more frequently at some hours than others, the truck arrival times should be graphed:



Estimating Manpower Needs—Five steps are necessary to estimate the manpower required for unloading carriers:

1. Record the intervals between the arrival of trucks (or railroad cars).

2. Study the time required to unload trucks (or railroad cars) and the specific methods employed.

3. Establish and appraise alternate plans for manning and equipping the dock.

4. Simulate operation under each plan using the results of the study of truck arrivals and estimated unloading times.

5. Select the best plan.

These steps should be applied to a simulated operation to achieve the best results. Simulation consists of operating a receiving system (or one of its components) on paper. It utilizes distribution of the time between the arrival of successive carriers, and the time required to perform operations such as truck unloading.

Careful construction of these distributions makes it possible to reproduce the operation of a receiving system by using times from the appropriate distribution and plotting the course of events on paper.

How to Conduct a Study—There are four steps to such a study. The first is to establish how frequently trucks arrive. It consists of recording the time (to the nearest minute) at which each truck joins the line of waiting trucks or passes the point where the line usually forms. If a gate guard issues truck passes, the time-in from each ticket plus the few minutes needed to travel from the gate to the dock vicinity may provide a sufficiently accurate figure.

Intervals between truck arrivals are determined by subtracting the times at which successive trucks arrive. These intervals should then be tabulated until a total of 400 or 500 have been recorded (see truck arrival data table).

If trucks seem to arrive more frequently at some hours than others, the truck arrival time should be graphed. Radically different slopes in lines indicate different arrival rates.

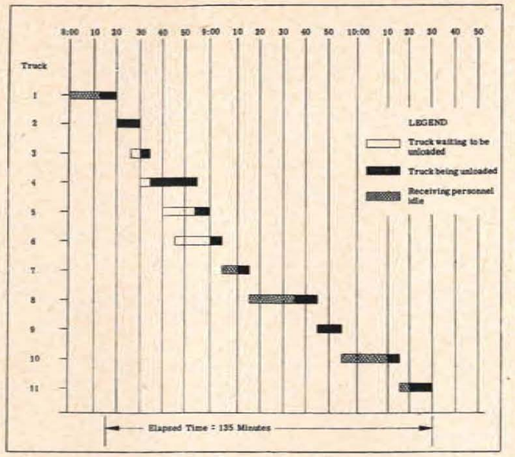
Any pattern of truck arrivals and railroad car switchings will be indicated if the name of the carrier is shown beside plotted arrival time.

Railroad cars switched in at the same time each day and the company mail truck which is waiting to be unloaded every morning at some departments are examples of arrivals exhibiting a pattern. These and others will be discovered in this manner. For carriers whose arrival exhibits a consistent form, 40 or 50 arrival and unloading times should be plotted separately.

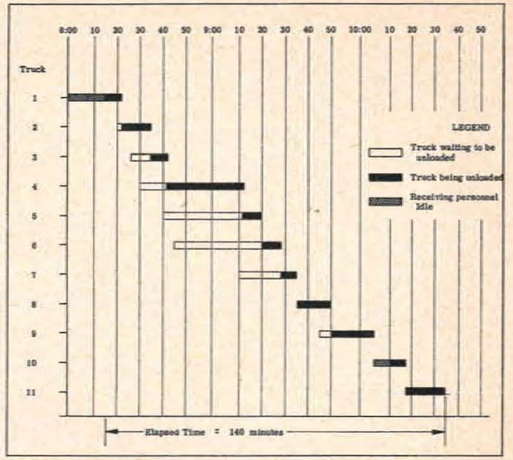
TRUCK UNLOADING DATA

Unloading time (minutes)	Number of trucks unloading in this time
Less than 2½ (1¼ average)	0
2½ to 7½ (5 average)	3
7½ to 12½ (10 average)	5
12½ to 17½ (15 average)	9

Simulation of Existing and Proposed Unloading Operations Simplifies Planning



EXISTING OPERATION—Simulation chart is constructed from truck arrival data and unloading time table. Receiving personnel idle time is short, truck waiting time is negligible.



PROPOSED OPERATION—Chart shows that new operation with same personnel handling twice the receipt volume is workable. Although truck waiting time is greater, it is not excessive.

The second step consists of studying unloading time intervals. While truck arrivals are being recorded, the observer should note the time required to unload each truck, the time successive trucks arrive at and leave the dock, and whether or not a line existed.

If there is no line, an estimate of the time trucks or railroad cars require to travel from where the truck line forms to the dock must be added to unloading time.

If there is a line, time between arrivals of successive trucks or cars at the dock is the unloading time. Following these two rules insures inclusion in unloading time of that period when the receiving crew was idle because one truck was leaving and another coming to the dock (see unloading time table on opposite page).

The third step concerns establishing alternate plans, however, before establishing any plans for unloading operations a careful study of all existing routines must be made. Revisions of routines affect truck or car unloading times, but do not influence arrival data. Therefore, new methods and new unloading times will be characteristic of each plan.

Suppose the manager of materials points out that increases in production will double the size of individual receipts in the near future, but that the number of men unloading trucks and verifying bills must not be doubled. A methods study indicates:

> The increased volume of receipts will be delivered by about the same number of trucks (this has been observed elsewhere).
>
> Improved methods will permit unloading the increased receipts in only 50 percent more time than is now required.

This information, with the tables of truck arrival and unloading times, provides the data needed to simulate operations under existing conditions and the revised plan. Both of these are carried out to illustrate the technique and how it can provide estimates of idle time, truck waiting time, and truck line length.

Simulating under different plans is the final step. Equipment required for simulation consists of wooden beads (or slips of paper), pencil and some round-bottom bowls.

On one group of beads (or slips or paper) should be printed truck arrival intervals. For example, truck arrival data might be reproduced by printing 1 minute on one bead, 7 minutes on five beads and 9 minutes on ten beads. All of these beads go into a bowl. Separate bowls would be used for periods when the arrival rate is substantially different, and when trucks arrive at specific times.

A separate group of beads representing the truck unloading data should be prepared and put into another bowl. Printing 5 minutes on three beads, 10 on five beads, 15 on nine beads, etc. would duplicate the unloading data in the table.

Simulation itself is quite simple. First, individual bowls of beads are mixed thoroughly. Then a bead is selected at random from the truck arrival time bowl. If it reads 30 minutes and the receiving operation starts at 8 a.m., this indicates the first truck would arrive at 8:30. Next, a bead should be selected at random from the unloading time bowl. If it says 10 minutes, the truck would be unloaded by 8:40. Repetition of this process might produce results like the tabulation shown.

The number of trucks waiting to be unloaded is found by looking down the bar chart vertically and counting the white bars. For example, between 8:25 and 8:30 there is one truck waiting to be unloaded; between 8:45 and 8:55 there are two.

Average waiting time per truck is the length of all the white bars (5 + 5 + 15 + 15 minutes) divided by the number of trucks (11) or 3-½ per truck.

Average length of the waiting line is computed by multiplying the number of trucks in the line by the portion of the simulation period during which the line existed. Separate calculations must be made for the time period when no trucks are in line, when a single truck is in line, and when two trucks are in line, etc.

In the existing operation, for example, there were no trucks in line 105 min. (135 — 30), or 78 percent of the simulation period. The line consisted of one truck for a

total of 20 min. (5 + 5 + 5 + 5), or 15 percent of the time. Two trucks were waiting simultaneously for 10 minutes or 7 percent of the period.

The charts can be helpful in determining these time periods. By moving from left to right across a chart it is easy to read the number of trucks in line at any one time and the length of the time periods.

Average length of the line then was 0.29 trucks (0 × 0.78 +1 × 0.15 +2 × 0.07).

Unloading and verifying personnel will be free 33 percent of the time (5 + 20 + 15 + 5 divided by 135). There are 135 minutes between 8:15 and 10:30.

Further simulation will determine the number of times idle periods will exceed some minimum interval necessary to permit performance of other receiving operations. From this data, an estimate of manhours which the truck unloader can spend on other operations can be obtained.

To be valid, estimates of average truck waiting time, average truck line length, and personnel idle time must be based on the simulation of operations for periods of many days. One way to determine the required length of the simulation period is to continue it until estimates of these variables obtained by simulation agree with those derived from work sampling studies. Such a check will make individuals more receptive to predictions based on results of simulation.

Now lets return to the situation where the manager of materials anticipates doubling the size of individual receipts, but improved methods will permit unloading these receipts in only 50 percent more time than is now required.

Simulation of operations under these conditions would normally consists of (1) establishing truck arrival times by drawing beads from the existing bowl, and (2) establishing new unloading times by drawing beads from the existing bowl and increasing each time drawn by 50 percent. The simulation should be continued for the period determined by the simulation of the present operation or until values for average truck waiting time, etc. stabilize.

Results of the simulation described here are shown in the charts. It is easy to compare the existing with the proposed operation. The average truck waiting time and the average truck waiting line for the proposed operation can be determined by the same method used for the existing operation.

Comparing Simulation Results

	Present	Proposed
Elapsed time to unload trucks	135 min	140 min
Receiving personnel free time	33%	3.6%
Average truck waiting line	0.29 trucks	0.84 trucks
Average truck waiting time	3.5 min	10.5 min

Proposed operation is feasible. Simulation has shown that receiving personnel can handle double the size of individual receipts and still have 3.6 percent free time.

While this example is for a dock with one truck slip, simulation of operations is possible when there is more than one truck slip. Truck drivers' practices, however, must be formalized into rules.

For example, a truck will go to an unoccupied slip on arrival if one exists, or the truck will go from the head of the line to the first slip that becomes open.

Bar charts for each slip and for the line can be prepared from the results of a simulation when these rules apply. Average number of trucks in line can be read from the chart. Truck delays, idle unloading, and verifying personnel time remain as before.

Other rules make it possible to reflect changes in manpower in simulated operations. Suppose simulation shows that a truck line will continue to grow if it reaches three trucks in length. It would then be desirable to assign additional personnel to unloading when the third truck falls into line, and to keep people on the job until the line disappears.

Effect of added personnel is reflected in the simulation by drawing unloading times from a separate set of beads of slips on which are written the faster unloading times. (Unloading time for any truck at the dock can be adjusted if the adjustment is made in the same way each time a similar situation arises.) Then, when the additional personnel are removed from the operation, unloading times are drawn from the original beads again.

A good picture of operations will require simulation for many weeks. One day isn't enough to achieve good results.

If truck arrivals are heavy, or if there are several truck slips, simulation may require some form of calculating equipment. Simulating operations in no way replaces the application of common sense to receiving operations. Simulation will indicate how much unloading time must be reduced or how much scheduling of trucks is necessary. Known techniques should be applied to improve unloading methods and dock arrangements.

Reference Material to Help You Analyze Your Handling Operation

RECENT *MMH* ARTICLES

Now—Predetermined Times for Materials Handling, July 1957, p 97. Tells about time standards for evaluating handling methods. Explains how they can be used to predetermine all cost factors.

How Operations Research Aids Materials Handling, August 1957, p 107. Describes new techniques that can take the guesswork out of decisions relative to the extent of loading and unloading facilities needed.

How to Analyze Handling Methods, March 1957, p 83. Contains chart of handling techniques.

USEFUL BOOKS

Work Sampling, Ralph M Barnes, William G Brown, Dubuque, Iowa.

Work Sampling, Robert E Heiland and Wallace J Richardson, McGraw-Hill Book Co, New York.

Motion Economy and Work Measurement, Robert L Morrow, The Ronald Press Co, New York.

Industrial Engineering Handbook, Harold B Maynard, editor, McGraw-Hill Book Co, New York, New York.

Timestudy for Cost Control, Phil Carroll, McGraw-Hill Book Co, N.Y.

Plant Layout and Materials Handling, James M Apple, The Ronald Press Co, New York.

Materials Handling, John R Immer, McGraw-Hill Book Co, New York.

Industrial Traffic Management, Newton Morton and Frank H Mossman, The Ronald Press Co, New York.

OTHER LITERATURE

Material Handling Bookets, *The Library of Know How*, published by the Material Handling Institute, Pittsburgh, Pa.

Booklet No. 1, What materials handling means and the benefits in improving methods.

Booklet No. 2, The tools you need to analyze problems, develop better methods.

Booklet No. 3, Organization of materials handling and its relationship to other functions.

Booklet No. 4, The functional operation of materials handling, the engineer and his training.

Measuring Receiving Performance

Performance of a receiving system can be measured by determining how well the physical system maintains the flow of material and how well the information system verifies and transmits facts.

There are eight yardsticks that can be applied to a receiving operation to measure its efficiency. Four of these apply to the physical system and four to the information reporting system. First, let us consider the measures of a smooth-operating physical system.

Labor Productivity is one of four measures that may be applied to the performance of the physical system. Most common unit of labor productivity is pounds per man-hour where:

Pounds = Total pounds of materials received.

Man-hours = Overall time required to unload and move materials, to verify carriers' and vendors' paperwork, and to prepare receiving reports.

Unfortunately these criteria are very frequently unreliable or too late for effective control of operations.

When the work load varies widely, only an average based on three days', a week's or a month's operations will be a reliable measure of performance. But such an average is available too late to effectively control operas they progress. When reasons for variation in the average from one period to the next are forgotten, needed changes cannot be effected.

To evaluate receiving system performance, labor manhours required for receipts at each receiving point should be estimated and totaled. This sum should then be compared with the total man-hours actually expended (as shown by time cards) by receiving labor other than clerical activity. If clerical activity were not excepted in this case, the two totals would not be comparable.

Generally, the actual man-hours will exceed the estimate because some idle time is inevitable if average carrier waiting time and flow time are maintained at specified values. For this reason, the report of estimated and actual man-hours required should be accompanied by a report of average truck delay and average flow time.

Unloading Delays—Unloading delay (demurrage) is a measure of labor productivity and supervisory effectiveness, when the volume of incoming materials is constant.

You can measure unloading delay by maintaining a log of the time each truck enters the plant grounds and the time it backs into the dock for unloading. Average of the lapse between these gives average waiting time.

This average should be compared with the estimated average waiting time figure used when plans are made for staffing the department.

Flow Time—Delivered materials should be in the storeroom or at point of use—not in the receiving area, where they are inaccessible and merely occupy storage space. But how fast should materials flow from the truck to the point of use or storage?

Some operating components specify that materials must be delivered to inspection or stores on the day they are unloaded. "Clear the receiving area by 5 p.m." is the rule. This is not an unworkable rule.

Operating units should be trying to clear all material through the receiving system, including inspection, and deliver it to the point of use or storage in not more than four hours after arrival. This desirable performance level will be necessary to minimize operating problems in automated plants.

Space Occupied—For a typical manufacturing component a receiving system (including inspection) requires between 2500 and 4000 sq ft of floor and dock space. This is based on the receiving systems in four GE operating departments which required space in this range despite the fact that:

1. Total receipts varied from 650 to 3500 tons per month and from 400 to 1200 pieces per day.

2. Dollar value of receipts varied from 2.3 to 7.4 million dollars per quarter.

3. Number of purchase orders ranged from 2,000 to 12,000 per month.

4. Total area of the departments ranged from 190,000 to over 1,000,000 sq ft.

In only a few cases did the maximum of one of these indices correspond to the maximum alloted space. The lack of relationship between receiving system area and such indices of receiving activity arises from the practices of:

1. Receiving large quantities of incoming material adjacent to the point of use and transferring them there directly.

2. Transporting such materials from the carrier's vehicle to storage without stopping within the receiving system.

Only apparent reason for variation in space required appears to have been major layout differences.

All of the previous checks apply to the physical system. But receiving is also vitally concerned with information reporting. And there are ways to check its performance too.

Performance Criteria

For the Physical System

1. Labor productivity or output per man-hour.
2. Demurrage or average unloading delay, ie, time a carrier's vehicle must wait to be unloaded.
3. Flow time or time required to unload the carrier's vehicle, to process the material received through the receiving system, and to move it to storage.
4. Space occupied by the receiving system.

For the Information System

1. Unnecessary outgoing information verification and transmission.
2. Age of receiving information made available to purchasing and material control.
3. Number of holds in the receiving system.
4. Cost of verifying and transmitting information.

Information flows from the receiving system via forms, telephone and messengers. Information also flows into the receiving system. Hence transmission in both directions is important. There are four checks which can be made upon the performance of an information system.

Like any other criteria, those for the information reporting system must be reliable, and must correctly indicate performance despite random variations in operations. These measures must be timely to facilitate the control of operations while they are in progress or before they are repeated.

Unnecessary Transmission—The receiving information system must verify and transmit data pertaining to what was received, how many were received, how many were acceptable, when the receipt took place, purchase order number, where and by whom the material was received, from what carrier, and collect freight charges that must be paid.

The information usually goes to purchasing, material control or the requisitioner and accounting.

The amount of duplication in outgoing information should be such that the time spent preparing receiving reports, plus the time required to rectify errors is at a minimum.

When duplication is high, both correct and incorrect information will appear on the paperwork, on other reporting media, and the cost of paperwork preparation will be high. On the other hand, the time required to establish which information is correct, and the cost of correction, will be low.

When there is little duplication of information in receiving paperwork, the time and cost of preparing it are low, but the cost of rectifying errors is high.

The amount of repetition depends upon the frequency of errors. This may be two or three errors per 100 receiving reports, but can be reduced to two or three per 1000 reports.

Age of Outgoing Information—How soon should information reach purchasing, material control and accounting? For the most part, this should be within eight working hours after the vehicle carrying the material arrives on the plant grounds. In some cases, it can be reduced to four or two hours.

Why the rush? In some flow shops, the need for rapid communication is obvious. Without it, additional expediters would be needed and phone bills would spiral upward. Elsewhere there are always rush orders.

Information must flow from the receiving system at a rate compatible with that of other data received by purchasing, production and inventory control. Generally, operating components receive invoices before the arrival of the material to which they refer. Accordingly, a stack of invoices accumulates which must be sorted to match invoices and receiving reports. If receiving reports reach the matching point more rapidly, the invoices accumulated will be fewer and sorting minimized.

Why should elapsed time be measured from the arrival of the truck in the yard? If the truck is in the yard, the material is in the plant. How would you, as a vendor, react to an expediter who called to inquire about a lot of material supposedly en route and, after checking with the carrier, you learned that the truck was in the yard but receiving was too busy to unload it? This has happened!

Most information should reach its destination in only a few hours after its generation.

Number of Holds—A Hold receipt is one that cannot be processed because information is lacking or erroneous. Receipts are held because the vendor has failed to indicate the purchase order number on or in the package or because receiving does not have a copy of the purchase order. Experience indicates that holds of 4 percent of incoming receipts would constitute acceptable performance.

Cost of Verifying Information—This should be compared with the loss which might be incurred if information were not verified. At one installation bulk material is delivered in open gondola cars. However, the weights of very few cars are checked since the cost of weighing is greater than the value of any loss so far detected.

Receiving personnel spend much time checking receipts that account for only a small percentage of the dollar value of all purchases. Because many procedures are set up on the basis that all materials are equally valuable, the possibility of reducing verification effort is one that should not be overlooked.

Planned Receiving Results In . . .

COVER STORY

Streamlining Handling and Paperwork

Here's how one of General Electric's top plants gets A-1 performance on its receiving dock. It's an outstanding application of key ideas described in "How to Plan Receiving Operations," Part I, MMH, Sept. '57 p.123 and Part II, this issue, p.141.

MILES J. ROWAN, *Editor*

Based on interviews with the following personnel of General Electric Company's Home Laundry Department, Appliance Park, Louisville, Kentucky:

DON H. ROHRER
Manager of Materials

EDWARD L. MUNSON
Purchasing Agent

CLYDE M. PURDOM
Materials Planning Supervisor

MASON C. OWENS
Materials Handling Specialist

CARL O. ANSERT
Receiving Foreman

There have been big changes in the receiving operation at General Electric's Home Laundry Department. Not so long ago, material could be buried in the dock area for a couple of days or more. Meanwhile, production lines might be getting dangerously low on parts.

Now, everyone knows what material has come in within an hour after it arrives. What's more, they know where it is and how to get it in a hurry if they need it quickly. Even in normal operations, all material is cleared from the receiving area within 24 hours after it comes in.

Receipts are recorded upon arrival and a complete up-to-the-hour status report is in the hands of inventory control people every morning. The receiving bottleneck has been broken and, with it, have gone excessive costs and expensive delays.

Behind this change are three things: better handling, rapid data processing, and streamlined organization.

Crane Handles Unit Loads

Handling has been vastly improved in the new setup. All incoming materials received loose are now palletized at the truck tailgate by the driver. Pallets rest on a section of portable roller conveyor, which is moved into the truck as materials are unloaded. An underhung crane takes pallet loads from the conveyor to one of 13 gravity roller lines opposite the truck well. After inspection, materials move on to storage.

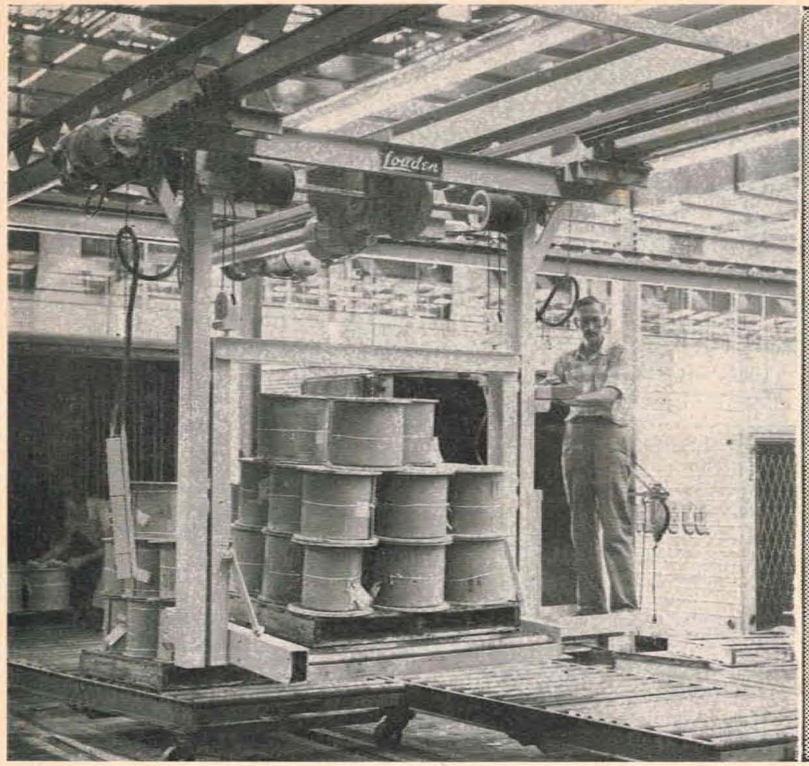
The crane is the basic handling unit. "Walkies" also are used for goods received in unit loads. The crane covers the entire dock area, is fast-moving and easy to manipulate. Getting a load is simply a matter of aligning the crane carriage with the portable conveyor. Pallets move by gravity partially off the conveyor and onto the crane. Powered rollers in the crane carriage do the rest. Unloading is just as easy. Pallets move in on one side of the crane carriage and off the opposite side.

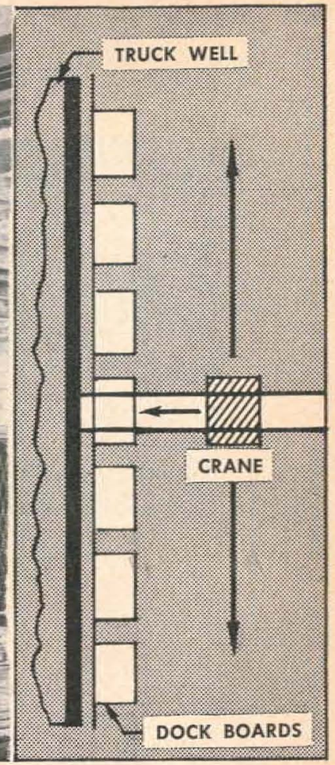
Accumulation lines are gravity roller. They provide ample capacity for a single day's receipts. Cartons are opened and checked on the lines before release to stores. Fork trucks carry on from the accumulation lines.

To improve handling further, truck loads are consolidated at a terminal in Louisville before delivery to the plant. Trucks also are scheduled in to the dock to avoid peaks and valleys in receipts.

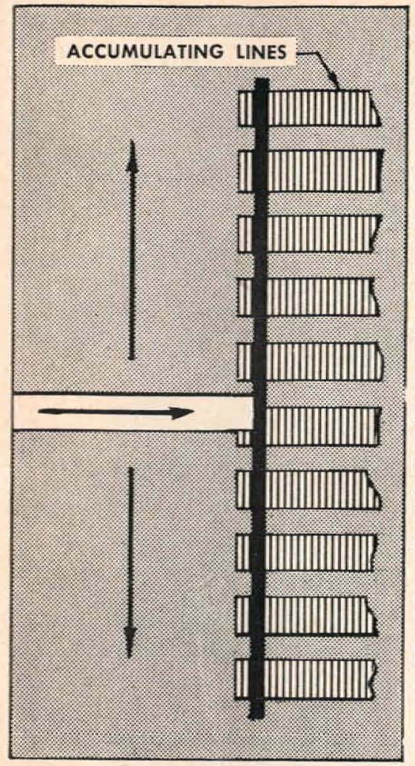
Tape Types Receiving Reports

One of the outstanding features of the new receiving operation is a high-speed system for handling paperwork. The packing slip moves to the receiving office, where girls prepare the receiving report. This is done on a teletypewriter equipped with a punched tape control. The punched tape contains about 90 percent of the information on the report, and operates the machine





AT TRUCK WELL unit-load crane picks up pallet from portable conveyor extending into truck, then moves load across deck to roller conveyor accumulation lines (see layout). Pallets are loaded by driver of the truck.



AT ACCUMULATION LINES powered rollers on crane carriage move pallet load onto conveyor. After inspection, materials move to racks, background, or to production lines. All incoming materials clear the receiving dock within 24 hours.

STREAMLINING HANDLING AND PAPERWORK, *cont*

automatically at 90 words per minute. The girls add only information such as number of pieces received, and the location of the material.

The tape is prepared automatically on a teletype in the receiving office at the same time that the purchase order is being typed on a teletype in the purchasing office. The tape, identified by order number, is held in receiving until the material on order comes in.

When the receiving report is typed in the receiving office, it is reproduced automatically in the purchasing office, accounting, and the computer room. Copies of the receiving report pass immediately to the incoming material inspection group located next to the receiving office.

With this system, purchasing men know within minutes of the arrival of material. Inspection is advised at once, and basic data for inventory control is fed to the computer section.

In the computer area, receiving information, and full data to indicate the status of all parts in the plant, are entered on punched cards. The cards then pass through a card-to-tape converter. Next, the tape is analyzed by UNIVAC, which prepares a report on the status of parts on the exception basis. The computer remembers the upper and lower limits of stock on each item, checks the balance on hand against these limits, and prints a report, listing those items requiring attention. The report goes each day to the inventory control men. These men also can check up-to-minute reports of receipts as the receiving reports are typed automatically on the teletype machine in the purchasing department.

Through these procedures, receiving information that is essential for control purposes is integrated smoothly into the over-all plant production program.

New Concept of Organization

The third reason for "top performance" in the receiving area is the concept of organization applied in the Home Laundry Department. The Materials-Manager is responsible for production control, purchasing, receiving, stores, product service and materials planning. Reporting to the Materials-Manager, the Purchasing Agent is responsible for purchasing, inventory control, stores and receiving. His organization is made up of 8 "commodity teams" consisting of a buyer, inventory control technician and stockkeepers. The foreman of receiving and stores are members "ex officio" of each team.

The buyer, as leader, has the over-all responsibility to get good parts, at the right price and time, to the right place. Each of the other members are expected to perform their function in the "flow of material" from the supplier to the first operation. This eliminates buck-passing and shifting of responsibility. The team approach results in everyone working together to keep costs down, quality up, and inventory turnover high, while schedules are met.

Equipment Selection Factors

The crane selected for the receiving operation is a standard 5-ton unit of the under-hung type, built by the Louden Machinery Co. The carriage has capacity of 2500 lb, although the basic unit load is planned for approximately one ton. Operation is completely pushbutton, with one set of controls at the operator's position, and a second set on a pendant on the opposite side of the crane. Controls are set to provide automatic leveling at the height of the gravity roller accumulation lines. The operator can by-pass this feature, however, and control the carriage height manually.

The portable roller sections used for moving materials out of the trucks are specially designed. They provide an incline so unit loads can be moved easily from trucks of varying heights. A total variation in height of truck bed of approximately one foot is permissible. The conveyor is equipped with a brake to prevent unit loads from rolling until released by the trucker. A second brake system, that can be released by the crane operator, prevents loads from rolling off the conveyor.

Built-in steel dockboards are used. These are of the counterweighted types, manually operated. They adjust automatically to changes in height of truck bed.

The track used to guide one end of the portable conveyor is recessed flush with the dock floor. It consists of a channel section, with an L-section mounted in the inverted position to provide a contour to match the conveyor wheels. This design is strong, does not easily bend out of shape under the impact of vehicles operating on the dock.

Track normally is used to position one end of the portable conveyor during unloading operations. However, the conveyor has been designed so it can be removed from the truck and rolled to one side without difficulty. This is necessary when trucks arrive with materials already palletized; "walkies" then are used for unloading. To shift the position of the portable section, the crane operator simply engages it with the crane carriage. He then can move the conveyor in or out of the truck or around the dock as required.

The crane is equipped with fluid drive for precise control and smooth operating characteristics. The crane carriage is specially designed to provide minimum carriage thickness and still have powered rollers. Minimum thickness is needed so the carriage can match the height of the portable section in all positions. Powered rollers make it easy to move loads on and off the carriage.

In operation, the crane has proved to be a flexible piece of receiving equipment. The entire system has proved to be effective in developing a smooth-running, efficient receiving operation.

To see how paperwork has been streamlined, turn page ➔

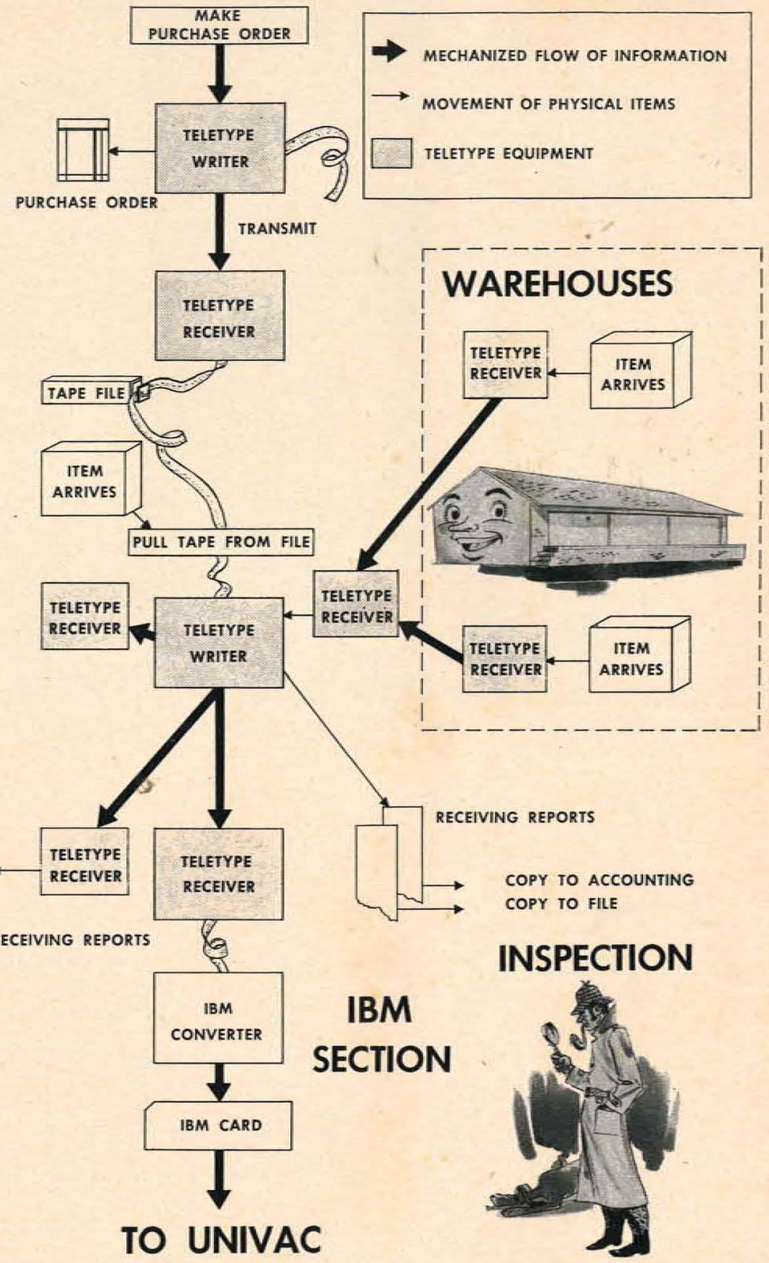
How General Electric streamlines paperwork for receiving

PURCHASING

RECEIVING

ACCOUNTING

MATERIAL CONTROL



STEPS IN STREAMLINED SYSTEM—1. Purchasing prepares purchase order on teletypewriter: Key purchase order information is recorded on punched tape in purchasing, and simultaneously in receiving. Tape in receiving is filed.
2. When material comes in, tape runs teletypewriter to enter 90 percent of information on receiving report automatically. Copies of receiving report are produced simultaneously in accounting and material control. Key information on receiving report is recorded simultaneously in IBM Section on punched tape.
3. In IBM Section, punched tape is converted for UNIVAC, which prepares daily report showing status of material for control purposes.
4. Warehouses report receipts to receiving by teletype. Receiving follows same procedure as if material had come direct to receiving dock.

TAPE-OPERATED TELETYPEWRITER enters 90 percent of information on receiving report. Operators type remainder.

UNIVAC analyzes receiving reports and other inventory control data, to give daily report on parts needing attention.