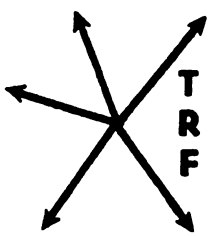
PROCEEDINGS —
Twentieth Annual Meeting

Theme:

"Transportation Alternatives in
A Changing Environment"

October 29-30-31, 1979
Drake Hotel
Chicago, Illinois

Volume XX • Number 1 1979



TRANSPORTATION RESEARCH FORUM

Impact, Knowledge and Choice — One Company's Management of Inbound Transportation

*by Arthur W. Todd**

THE POSSIBLE SAVINGS to be gained by the intelligent control of inbound transportation to a manufacturing plant are presumed to be large, but from the standpoint of overall management they are vague, elusive and difficult to achieve. Numerous articles on the subject have recently appeared in print, including one by this author in the January 1979 issue of Handling and Shipping Management, page 29, under the title "Panning for Gold in Inbound Transportation." All of these presentations are necessarily brief and all too often consist of generalities. The purpose here is to find out how much of what, and what can be done about it. By necessity, the facts are obtained from the records of a single relatively large and well managed central, manufacturing and management location. The assembly of facts should provide a guide for anyone who wishes to study the issue from a more comprehensive, or different standpoint.

The chief aspects which make any study of the area difficult are:

1. There isn't any "whole," that is to say a readily available set of figures to show how many dollars are spent on what movements in relation to which commodity values, and comparably no standard against which performance of the actual can be measured.
2. The whole sphere of purchasing is in a constant state of flux, governed for the most part by factors which have little to do with transportation and interlaced with incidents of urgency which, again, have very little to do with transportation and are primarily the end result of poor forward planning.
3. In one way or another, every function and every person will ultimately be judged by how well it or he performs in relation to optimum performance. Here again, facts as to inbound transportation are on the one hand unavailable and on the other minor in relation to other aspects of cost; thus a real incentive for improvement is lacking.

As to manufacturing businesses, the ratio of purchases to sales has historically always been between 40% and 60%, with a great concentration in the 50% range, and this remains true through the years and virtually regardless of the kind of business and the extent to which manufacturing on the one hand is mostly an assembly operation or on the other involves also the processing of a number of basic materials. As one example, the Ford Motor Company has for years run a steel mill, and has been in and out of the ball bearing business, and countless other supply functions without notably being more or less successful than General Motors Corporation, which has no steel mill. As a generality, the satellite manufacturing operations of General Motors such as Delco supply many other businesses in addition to the parent. Typically, Ford Motor Company has not done so. Further, many of the suppliers who serve the automotive companies also supply Lincoln, and in other cases, Lincoln suppliers make a point of not serving the automotive trade because of the nature of their purchasing policies, yet offer comparable products. The essence of the point is that the Lincoln experience may be presumed to be typical, subject to a showing that it is not.

Again applying averages, it is likely that the average transportation cost on all manufactured articles is less than 4% of the value of the goods moved. For those companies who pay and absorb all or a substantial part of the transportation bill between themselves and the customer, the outbound freight may run as high as 6% of the value of the goods shipped, whereas on inbound materials the freight runs closer to 2% of value and at most 3%, except as to certain materials where the price is low and the freight correspondingly a high percentage. In all probability the differ-

**Director of Purchasing, The Lincoln Electric Company, Cleveland, OH.*

(Note—This is the initial draft of the paper, submitted as required by April 15, 1979. It contains a number of figures which are close estimates. It will not be possible to verify these figures until May 1, 1979. If the paper is accepted by the Committee, specific figures will be checked or revised by June 1 in ample time to meet the printer deadline of June 20, 1979.)

ence lies in distance. The largest proportion of all manufactured goods travel by common carrier truck as to which the average length of haul is in the area of 350 miles. The C&O—Erie, Pa. survey of years ago showed that most business is short-haul in this manner and that all transportation runs pretty much as the street cars used to, with many riders getting on or off as the vehicle proceeded, with only a few who ride the full distance. The lower percentage on inbound reflects the natural tendency, whether expressed or not to confine purchases within the smallest geographical circle which will consistently supply the goods, whereas the sales division has the incentive to expand the market to the broadest possible geographical area on a marginal basis, which is to say — all places where the marginal profit achieved by the greater production is higher than the incrementally higher cost of serving the market. The purchaser is always reluctant to lengthen his lines of supply because the problems of communication for any purpose are increased by the mile; the salesman is always seeking to broaden his market by offering concessions, the most overt of which is to equalize freight so that delivered costs will be comparable. This assumes, of course, that both buyer and seller know what the freight costs actually are. When life was simple, all freight rates were freely available from published tariffs. With the advent of private carriage, contract carriers and lessened and possibly total deregulation, no one will know where anyone stands and the tendency will be towards all vendors delivering on a fully freight prepaid basis — thus terminating one big area where finite savings "on the book" can be realized.

We have noted that inbound freight costs may be 3% of the value of articles purchased, on the average. Using the 50% figure (in relation to sales) the total inbound freight cost will not exceed 1½% of total sales. Using our old figure of a savings of 20% between uncontrolled freight movement and highly sophisticated management, we have a maximum net influence on profit in the area of 3/10 of 1%. The median profit of "all enterprises" is 5%; thus our potential is 6% of "all profits."

Costs listed on freight bills are only a portion of inbound total costs. Other aspects include intermediate storage, costs of opening or unloading packages are containers and other in-plant operations prior to placing the material at the point where it will be used — which costs are at least equal to the invoice freight bill. Using this addition, the margin between good and bad is .6%, or one-eighth of the average level of profit in all too many industries, and is a figure deserving of study.

The invoice costs of inbound freight are in themselves obscured by the manner in which they are levied — some by actual carrier bills, some by adjustments on the face of material invoices and some less directly by options to "avoid transportation" by buying from local distributors, of whom there are a great number. In a total picture of about 2¼%, freight costs to purchases at Lincoln, only the first 1% will show upon freight bills and the balance of specific figures will appear on material invoices. The increased costs, to the extent there are any, by using local distributors will not be shown on any invoice and can only be surmised. Typically a distributor cannot operate on less than a 15% margin, as to which 10% (or more if there is more) relate to selling, general overhead and warehousing and 5% relates to outbound freight from distributor to customer.

When freight charges are listed on material invoices, they are probably applied to the total purchase cost. Where freight bills are rendered separately they may or may not find their way into the specific cost of the materials. In other cases they are charged to a general account and are applied as a total purchasing or manufacturing cost without discrimination as to material. In this case it is difficult to demonstrate a saving even if it is achieved.

United Parcel has become our largest motor carrier in revenues and it dwarfs any other service for goods movement in terms of number of shipments. One reason for this is the heavy use of UPS for industrial purposes. Of the 300 purchase orders issued per day by Lincoln, between a third and a half will arrive by UPs. By reason of billing "by the package" and limiting per package weight to 50 pounds (thus enforcing the containment of "little packages" where possible), UPS, being a virtual monopoly, probably represents the peak of possible efficiency in this sphere.

UPS, and some other carriers who are much smaller but of a comparable type, are specialized carriers who have been relatively free to determine their own rate structures and thus can and do provide incentives to shippers to "ship in the right way." In particular, this structure maximizes single containers at the 50 pound level with none accepted which are heavier and while any number of packages can be shipped at one time to one destination, the per package charge renders large shipments non-competitive to other modes. Further, the requirement that UPS charges be prepaid, or COD

at a high penalty forces the channel of payment into the optimum direction, and a simplified rate structure based on Zip zones makes it easy for those shippers who choose to do so, to add UPS charges to the face of their invoices. In addition, UPS by being virtually a monopoly in its field, has an optimum pick up and delivery operation.

The posture of the motor common carriers as to "small shipments" is substantially the reverse. They have no monopoly. Any effort to channel the variety of shipments into a small number of carriers by a multiple shipment discount, or any plan to provide a rate incentive for efficient shipment methods has been beaten down by vocal action of the same shippers who would gain the most by improved transportation methods. The motor common carrier has a further disability in not knowing, normally which shipments involve any movement priority and thus endeavors, though they frequently fail, to give prompt service on all of them. Movement by pallets or in cages or containers cannot be handled optimally because of the problems of return or exchange of these devices.

Private carriers, that is, trucks operated by the owners of the goods, suffer none of these handicaps. They have a problem only in keeping the vehicle reasonably full throughout the outbound and inbound movement. Those who are familiar with the present and recently relaxed requirements as to "filling out" understand how to compensate for this problem. Beyond this, they can use any kind of device which will expedite handling; they can schedule priorities for loads or in the alternative, accept such schedules as once weekly, and they can provide various sorts of destination services which can only be provided by common carriers at an excessive cost to the carriers, or to the businesses served. If there is a virtue in deregulation it is that a particular carrier could where warranted shape his service or rates so as to compete more effectively with private carriage, without having his modifications stopped by the actions of competing carriers.

A decision to use private carriage will normally be based on the circumstances of outbound transportation, as to which the time and size of movements is largely under the control of the shipper. It is a logical, but far more difficult task to plan and justify private carriage on the circumstances of inbound transportation. If the primary source of purchased commodities is a supply in being, or, stated more clearly if the preponderance of inbound movements is of commodities already in a finished condition and in warehouses ready for movement at optional times, then such an operation can work easily and well. If however the preponderance is in goods manufactured or prepared to order, the purchaser has very little control over the size and time of movement and the scheduling of loads becomes very difficult. Indeed the rather simple concept of accumulating shipments at a centrally located origin city for truckload movement to a purchaser is not something, in practice, which can apply to more than a few cases.

Circumstances in this area do not change with the passage of time. Lincoln has made several studies over the years as to the feasibility of such a project with negative results. It has not been possible even under occasional truck strike conditions to mobilize goods in any one area with any practicality, let alone efficiency.

The results of a study made in 1977 based on a review of inbound bills of lading showed as to shipments inbound of less-than-truckload size from Eastern Central territory (roughly, Rochester, NY, Johnstown, PA and east) in a month's time, 35 vendors shipped 92,998 lbs. of assorted merchandise. The largest volume was 12,777 lbs., consisting of 13 shipments. The next largest were three shipments from Chester, PA totalling 8,700 lbs., five from Providence, RI at 8,887 lbs. and 11 shipments from Chicopee, MA at 5,468 lbs. There was no feasible way in which these could be consolidated.

In December 1977, under the auspices of the Engineering Foundation, the third conference on the Urban Movement of Goods was held in Sea Island, Georgia to examine the scope of the problem and the principal issues — whether something could be done to increase substantially the 30% of capacity loads which are typical of urban freight movements, and how excessive waste of time could be eliminated at any point in the journey. Most of the participants either had theoretical answers, the operation of which would be doubtful in practice, or concerned themselves more with patent obstacles such as poor highway design and grade crossings of incompatible modes than the more realistic aspects of queuing time caused by inadequate receiving facilities which, probably, the sponsors conceived as beyond the reach of either study or improvement.

Inasmuch as the Lincoln facility, by design, is substantially free of receivement interference, a brief study was made for a period in 1977 to indicate what actually happens when a centralized operation purchases a thousand tons daily from 2500 scattered vendors over an average length of haul of a hundred miles for a daily purchase cost of $600,000 a day.

The study showed in the first place that the diversity of type of inbound movement, plus the outbound movement of other than finished goods such as scrap and rubbish is far more complex than anyone realized and that even a facility carefully designed to optimize the rapid movement of goods for production from inbound truck to point of application with no receiving storeroom could be taxed to the limit by all of the inbound movements which do not fit a theoretical pattern of efficiently packaged merchandise.

INBOUND

A) Partial list of vendors, by type, delivering in their own trucks

	No. of Vendors	No. of Stops	Total Hours
Packaging supplies	23	64	65
Metal Warehouses	22	53	41.5
Platers & Heat Treaters	9	39	23
Office Supplies	10	12	6.5
Fasteners, Mill Supply	14	26	15
Electrical Distributors	6	19	8.5
Bearing Distributors	2	6	3
Lift Truck Parts	2	3	3

B) Total vendors: 138 companies, 301 stops of which 197 took 0.5 hour,
76 took 1 hour,
28 took 2 hours or more

C) Other transportation companies on inbound goods

	No. of stops	Total Hours
68 motor common carriers	193	170.5
3 tank truck lines	10	13
9 steel haulers	35	46
8 dump truck lines	52	47.5
88 carriers	290	276
local cartage companies	44	26
service companies	10	7.5
local contract carrier	5	8.5
parcel post	5	4.5
air freight	13	8
United Parcel Service	8	8
employees	2	2.5
customers	2	1
Totals at main receiving dock	89	66
Totals applied to inbound	680	342

MISCELLANEOUS

Cafeteria supplies	41	21
Rubbish removal (5 contractors)	81	63
Painting contractor (1 company)	8	14
Machinery mover (1 company)	13	50.5
City of Euclid inspectors	2	1.5
Cleveland Electric Illuminating Company substation	1	1
Vending machine operators (4 companies)	25	49.5
Employees picking up salvage for sale	22	11.5
Coal (some was stockpiled in July)	12	7.5
Norfolk & Western Railway	1	1
TOTALS	206	220.5

SUMMARY OVERALL TOTALS	No. of Stops
Outbound	602
Inbound	683
Miscellaneous	206
	1,190

Average — 186 stops per day[1].

1 Goods Transportation in Urban Areas, June 1978, FHWA-PL-78-012 (NTIS)

There are circumstances in the Lincoln purchasing system which should make it more efficient than most, and as a result yield a more adequately disciplined inbound movement than most. The practice is to confine sourcing to the minimum number of suppliers needed for the purpose, to provide adequate lead times as to all types of materials for any usage in all but extreme cases, and to accept the circumstances that inbound movement must be on the most cost-efficient and not the speediest method.

The Lincoln purchasing program has a prominent disability in the almost ungovernable tendency of vendors to split orders into several lots which in effect result in two or three purchases when one would suffice. This supposedly is done in the interests of good service but in reality it is extremely costly and, of course, proliferates the bad aspects of inbound movement. A plan is under way to "fine" such vendors, since no other system seems to work.

The average purchasing operation is anything but that. Goods are literally purchased at random, often from the maximum number of vendors who can be accommodated as a theoretical hedge against inability to deliver, and with lead times which bear little or no relation to reality, resulting in constant expediting and shifting of schedules. Grossly poor production and inventory control procedures and equally grossly poor purchasing practices are at the root of most of the wastage in transportation which the urban goods conferences and other studies aim to cure.

In defense of the present situation, it should be said that the production and inventory control people, even though in most cases the word "control" means nothing in practice, are making a diligent effort to improve the situation through countless seminars and other aspects of professional development. The purchasing people, if they are doing anything to improve the situation, keep their activities so quiet that nothing is really noticed, principally because they view themselves as valets and chaffeurs and not as prime movers in the industrial scene.

The circumstances described create a "scatter" as to sources of inbound materials. Various economic trends are forcing a development in the other direction. Very substantial increases in fuel costs and significantly higher labor costs in transportation — both in relation to the increase in the general price level — will force purchasing into shorter distance channels and less frequent deliveries. The practice which was the rule a hundred years ago of channeling most "small things" through local distributor channels insctead of a myriad of small shipments direct from a manufacturer is tending to reappear. Where there is a really large volume to be procured in a wide geographic area, and perhaps to be reshipped into an equally wide spread of manufacturing or distribution facilities, regional consolidation centers are operated by such firms as S. S. Kresge Company, the parent of K-Mart.

The only proper way to review any inbound movement is to consider all of its aspects from origin to destination to determine what, in essence, is unnecessary and can be left out or added later. The most obvious aspect of this search has always been to shop articles "KD" (knocked down) instead of fully assembled — a technique which may work as well with large machines as it does with bicycles. Dense articles almost always move more cheaply than bulky ones. (But nobody has discovered how to ship tires flat!) We have space only for a couple of instances.

Rutile is a sand-like ore of titanium, the end uses of which chiefly are to make white pigment and metal. Traditionally this ore was packed in canvas bags weighing 112 lbs. The "reason" for this brutal weight was that it was 1/20 of an English ton. It took the charge of a marine with flashing bayonet to open these bags, which were neither reusable as bags nor useful in the processing. Somebody came up with the idea of shipping this material as if it were sand, notwithstanding the then values of $2 per ton for regular sand and $100 a ton for rutile. The instant objection raised was that thee would be a great loss in transit. Fortunately, bulk shipping was tried in practice and found to cause a loss in the area of 1%. The extra cost for bagging, handling and opening bags was a premium of not less than 20%. Net savings by shipping in bulk, 19% of the merchandise cost disregarding a reduction in ocean shipping charges from $25 per ton as "merchandise" to $10 as a bulk commodity.

Light, small machines were imported. Tradition said that these must be shipped each separately in some kind of a wooden package to stop pilferage and reduce damage in transit, though if someone were determined to pilfer it would be easier to abscond with the whole crate. Imagination said that these should be shipped in cardboard boxes. The crates were so uneconomical that total cost limited importation to a trickle; regular cartons were not adequate. Engineering showed that these machines could be packed, six to a master carton in a special triple wall cardboard device which, to be sure, was expensive but less materially than six separate smaller cartons plus packing. Result: the machines are imported reg-

ularly when none could have been imported before.

When the whole cost of transportation is considered and not just the freight bill, many other aspects come to light. For example, if scheduling and transportation are properly handled, the occasion for tracing should be very limited. Rather than set up an elaborate tracing mechanism, the optimum answer is of course to eliminate the need for tracing. From the standpoint of producing goods, tracing whether in purchasing or transportation is a total waste of time. Yet it is a common observation to see otherwise talented people spend their entire day on tracing operations. Not a pound of product, not an idea of any value comes from a day spent in this manner.

Incorrect and damaged goods (and the incorrect instances outnumber the damaged ones 100 to 1) are a problem which is barely realized. The whole subject is about as welcome in any operation as cleaning out a sewer. It is a difficult matter even to achieve a disciplined handling of these instances. Unpleasantness doesn't cost a whole lot but the labor of handling these instances does. We estimate that to straighten out an error costs ten times as much as if the operation was done correctly, hence if there is a 10% error factor in any operation, progress is at a total standstill. We endured at one time a 50% error in the purchasing function. This is about as uncontrolled as a raging sea. About all that could be said for it is that it remained on earth instead of taking off for the sky.

Transportation people, inventory control people and purchasing people can investigate these things but they don't get very far, because they are looking at details rather than the whole picture. In an egocentric sense they take themselves, and thus, things, as they are for granted instead of asking themselves whether they are, themselves, justified or more plainly, whether everything they do is justified. Realistically, this is an overall management problem.

Any study, to mean anything, should examine the real costs as well as those which appear on some invoice or bill. The nature of economics is that every operation must sooner or later justify itself costwise, and the more active competition develops or the more far reaching government regulation is intensified, the sooner this day comes.

For example, what is the true cost of storage, which must occur at almost any point in the long chain between origin and use? "Storage" in this sense covers costs which are non-financial. Beyond this is the financial cost of maintaining inventories. Popular understanding of inventory costs is badly distorted. The beginning axiom usually is that the more our business increases, the more our inventories need to be expanded — when the fact is that the one has virtually no relationship to the other. If this were not true, our supermarkets would be monster Ma and Pa groceries with so many items in storage that it would be impossible even to bring them to the counter. For the uninitiated, the average stock in a retail supermarket is two days worth and a wholesale serving operation would collapse if it had any more than seven days worth on hand. Considering the nature of some items making up the average, twice daily deliveries of others are needed.

Considering the widespread ramifications of "inbound goods," the overall supervision of these activities must of itself be a management policy. That is to say, it is not enough that management be sufficiently interested to see that a comprehensive and workable policy is developed — it must go further and make, in some manner, a constant review of these operations and policies itself a policy. This will not be accomplished by fiat or order. There are too many conflicting and unknown circumstances and too many projections of future methods and volume to permit any aspect of this operation to be jelled in a stationary format. They must be reviewed frequently, in person, by what in essence is a committee, no matter what its title or powers may be, or how fixed or flexible its personnel may be.

Even this is not sufficient. There must be on the one hand some aspect of the total management framework which will ensure that decisions, once rendered, are actually carried out. On the other and somewhat comparably, but from an "outsider" rather than a participant viewpoint there must be some kind of an audit function which not only ensures that steps agreed to be taken are actually taken in the right manner, but further that both plans and accomplishments really achieve, on a total cost basis, the results they are intended to achieve.

From the financial or "figure" standpoint, it is a relatively easy matter to design an information system which can be reported automatically by computer or other methods showing alternatively, totals, percentages, exceptions and ratios. Any such system would have to be based on cost or operating standards. The simplest and most obvious, for the purpose of this paper is to analyze all cases of premium transportation paid and allocate these to the causing function. In our case there are four separations, three by three manufacturing divisions to cover cases in which goods were requested to be delivered in ad-

vance of the originally scheduled delivery date — which dates are set on the basis of the suitably revised lead time tables. The fourth category includes all premium costs associated with purchasing, including erroneous or unjustified premiums which are billed back to vendors, and extra charges caused by the failure of the purchasing function to bring in the goods within the lead time specified by them, regardless as to the cause of the deviation.

Normal inbound freight costs are a part of the total cost of raw materials, and in most cases not segregated out as separate figures because no purpose has been shown for doing so. The definition presumes that such costs are reviewed and that any cost other than normal is charged to some other company or function. If freight costs are to be segregated, it is probably the easiest procedure to do so on the basis of LIFO classes, or pools, inasmuch as the LIFO accounting system requires adjustment of material costs on the basis of these pools.

A separate audit of inbound transportation includes, of course an examination to show that freight charges are paid on "correct" movements and at the correct rate.

The shortcomings of these audit procedures are that the actual transportation method may not be the best method, and that procedures of any kind designed to optimize performance on a total overall cost basis are not really followed. There must be a methods improvement function which will repeatedly re-examine significant movements to update operations to the newest techniques for overall cost reduction — a never ending job. There should be a procedure book, if it is possible to write one, which will cover all standard procedures and be accessible, and used, by all persons having some relation to guiding the function.

Lastly, some person with a "detective sense" has to keep watch on all aspects of inbound movement, to report all circumstances in which the operation is not as it should be, and get these situations corrected. This kind of auditing is neither pleasant nor popular. The obvious conclusion to be reached is that, no matter how unpleasant corrections may be, they are less unpleasant the sooner they are corrected. If correction is postponed too long a time, there will be nothing to correct, because the whole enterprise will have fallen by the wayside.