THE RAILROADS' ROLE IN THE MOVEMENT OF MERCHANDISE FREIGHT

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The purpose of this paper is to examine ways in which railroads might (a) improve service and (b) improve capital utilization without increasing long-run total costs. Rail freight costs and truck costs are compared in considering the effects of a shift from truck to rail. In order to examine the full economic cost approach to rail and truck capital investment it is necessary to include, first, the recovery over the expected economic life of each investment of the amount of capital that would be required to replace that investment today and, second, an additional cash flow adequate to provide an average return on the investment of 9 percent after taxes. The justification for applying the capital cost approach is (a) to make enough money to replace equipment as it wears out at the prices that will prevail at that time and (b) to make enough profit to guarantee continued accessibility to the capital market. The validity of this approach to the cost of doing business has long been recognized in many capital-intensive industries but not in the railroads. This paper also describes some of the reasons rail car utilization is low, among which are (a) the low average line-haul speed, (b) the fact that 62 percent of the days attributed to line-haul are spent standing and being switched in intermediate yards, and (c) the fact that the average line-haul train is 1 hour late for every 200 miles traveled. There are many ways in which the railroad industry can and should improve utilization. This paper examines some methods for accomplishing this, including car control systems, operating strategy changes, physical improvements, and pricing changes that reflect and encourage actual equipment cost levels.

•WHEN people are suddenly confronted with problems that they perceive to be of crisis proportions, they tend to search the horizon for someone or something that can provide a simple, comprehensive solution. In the midst of a fuel shortage, the shock of which followed closely on a general awakening to environmental problems, there are some in the transportation community who are looking to the railroads as the solution. At the same time the railroad industry, being badly in need of a benefactor of its own, has begun examining its abilities to meet these needs. This attitude, and the most basic problem faced by the industry in meeting those long-term needs, was summed up in an article in Business Week (1) that stated, "According to all the theories of railroad operation, railroads ought to be enjoying their biggest profits in history. They are not. American railroads are in bad shape despite dream levels of business."

So before anyone begins contemplating wholesale shifts of intercity freight moving from trucks to rail transportation—both boxcar and trailer-on-flatcar (TOFC)—it would seem advisable to consider the effects of such a shift in terms of the fundamentals of land transportation economics. The first of these fundamentals is that traffic generally moves by truck because of the service, and any wholesale shift of merchandise traffic will require a rethinking of current rail reliability and transit time. The trend for many years has been for merchandise traffic to shift away from rail to truck, precisely because trucks can provide superior service at what is generally only a modest increase in transportation cost (and frequently a lower total distribution cost to the shipper). The second fundamental is that the railroads do not currently produce an adequate return on their invested capital. In recent years, rail carriers as a group have had one of the poorest earnings records of any industry. The Task Force on Railroad Productivity final report (2) stated that, during the past 10 years alone (1962-1971), the railroads have committed $10.3 billion, just over three-fourths of their gross capital expenditures, to equipment. The marginal rate of return on this investment has almost surely been low: Even if the entire net railway operating income of the past 10 years were attributed to this $10.3 billion investment in rolling stock alone, the rate of return would have averaged a mere 6.7 percent per year.

That is about the best definition of a capital crisis I have ever heard. And Federal Railroad Administrator John Ingram recently said (3), "Certainly the earning of an honest return on investment is something we should strive for, because that's what is going to produce a good rail service in the future."

The intention of this paper is to examine the ways in which the railroads might (a) improve service and (b) improve capital utilization, without increasing long-run total costs.

ECONOMICS OF LAND TRANSPORTATION: ARE RAIL BOXCARS THE LOW-COST MODE?

If one compared the average direct operating costs of present-day carload, rail TOFC (piggyback), and truck transportation, based strictly on published industry average cost data (4), the results would not disrupt any preconceived notions. Based on average industry performance, both rail carload and TOFC services have lower operating costs than truck transportation. Stated in terms of average cost per ton-mile, truck operations cost approximately 4.5 times as much as rail carload operations and 3.9 times as much as rail TOFC operations.

But the costs reflected in the published industry accounting data are not the total costs for either rail or truck. The total cost of conducting a business includes the cost of attracting and providing the capital investment required. And capital costs cannot accurately be measured in terms of accounting costs but must be measured over the time in which a current decision will have its effect. Accounting is, by definition, historical; it determines values based on past events, such as the price and anticipated life at which equipment was purchased. It does not measure the future effect of a decision to reduce maintenance expenditures in return for a shortened investment life or the future effect of purchasing a more expensive piece of equipment that is expected to last longer. Such analysis requires a more extensive investigation of total capital requirements.

When a full economic cost concept is applied to the various land transportation modes, a somewhat different picture emerges of cost competitiveness. Based on existing average loads and lengths of haul, the operating cost advantage that carload traffic enjoys over trucks is reduced by half when full capital costs are included, and the operating cost advantage of TOFC is reduced by 40 percent. However, the question this paper is considering is, "What happens if certain traffic is diverted from truck to rail?" Truck traffic, on the average, is carried a shorter average distance than rail traffic. Thus, if a comparison of full economic costs is made, assuming that traffic with an average length of haul of 265 miles is being carried by each mode, it becomes even more obvious that rail transportation does not always enjoy the substantial cost advantages it is generally assumed to possess.

Just what needs to be included in a full economic cost approach to rail and truck capital investments? First, the recovery, over the expected economic life of each investment, of the amount of capital that would be required to replace that investment today, and second, an additional cash flow adequate to provide an average return on the investment of 9 percent after taxes. This level is not excessive. It is characteristic of other capital-intensive industries, such as telephone companies and airlines. The annual cash flow necessary to cover these two elements has, of course, been adjusted to account for the discounted value of future dollar returns.

The justification for applying the capital cost approach outlined here is simple: If you want to stay in business over the long run, you must make enough money to (a) replace your equipment as it wears out, at the prices that will prevail at that time, and (b) make enough profit to guarantee continued accessibility to the capital market. The validity of this type of approach to the cost of doing business has long been recognized in many capital-intensive industries, such as petroleum, chemicals, and automobile manufacturing. In other industries such as steel manufacturing and the railroads, it has been, and in some cases continues to be, denied. In both steel and railroads, the effects of this denial were suppressed over time, primarily because of the relatively long (in some cases almost indefinite) economic life of plant and equipment. But the impact is such that today a large part of the rail industry is in bankruptcy while the rest is struggling with the problems of replacing the investment base.

UTILIZATION: THE KEY TO TRANSPORTATION ECONOMICS

It is readily apparent that the key to lower truck capital costs per productive unit (ton-mile) is not the lower unit cost for a truck trailer as opposed to a rail boxcar. Actually, the unit cost per ton of average load is very similar ($533 for the rail car as opposed to $500 for the truck trailer). In addition, a rail car will, on the average, last 3 times as long. Neither is the difference in capital cost per ton-mile explained by the much higher unit cost of a rail locomotive, for the unit cost per ton of average load is almost 3 times as high for truck traffic.

The fact that truck capital costs per average ton-mile amount to half of rail carload ton-mile capital costs (and 60 percent of TOFC) is explained very simply by equipment utilization. The average truck trailer, in spite of a 65 percent smaller load in terms of tonnage and a 48 percent shorter haul, will produce as many revenue ton-miles in its 10-year life as a rail boxcar (which costs almost 3 times as much) produces in 17 years.

What makes up the components of rail car utilization, and what are some of the things that might be done to improve it? First, let us look at each of the several components of a rail car cycle, and identify the problems inherent in each.

Time Spent in Loaded Line-Haul

A recent study of rail car utilization conducted for the Federal Railroad Administration indicated that only 25 percent of the average 29-day boxcar cycle is spent in the line-haul function (5). For an average 500-mile haul this would indicate an effective line-haul speed of 3 mph. But the fact is that fully 62 percent of the 7.1 days attributed to line-haul are spent standing and being switched in intermediate yards. Other sources indicate an average line-haul speed between terminals of slightly over 20 mph for carload service and up to about 37 mph for some TOFC trains. These speeds compare with effective truck speeds, including authorized driver stops, of from 30 to 42 mph, depending on the region of the country.

Intermediate yards are one rail element with no counterpart in a truck operation. The need for them is dictated by the railroad practice of batching traffic moving over major line segments, almost without regard to origin, destination, or, in many cases, type of traffic. It is a fairly common railroad practice to handle TOFC cars, for instance, through the same intermediate yards (including some hump yards) as any other type of car.

It must be pointed out that the frequency with which railroads run cars through intermediate yards [the ICC estimates one such yarding for every 200 miles of line-haul (6)] is not inherent or essential in the nature of rail operations. Fewer yardings, and even direct origin-to-destination trains, are possible and are the practice in some places; that they are not the norm is perhaps often due to the common operating philosophy of sacrificing capital costs in order to minimize operating expenses.

A recent study for the U.S. Department of Transportation demonstrated that intermediate yards are the primary source of the low transit reliability that railroads generally provide in carload service (7). Because of railroad efforts to minimize train operating costs, many rail links, even on heavily traveled segments, have only daily or twice-daily service. Thus a car that arrives even a few minutes past the processing cutoff can be subject to a delay of from 12 to 24 hours, in addition to the average 16 hours it takes to process the car through the yard. And the same study indicated that the average line-haul train will be 1 hour late for every 200 miles traveled. How this reliability might compare with truck service is not necessarily the issue; what is important is that, whereas over-the-road truck delays are generally measured in hours, any delay in through train service (because of low frequency of service) can result in shipment delays of up to a day at each intermediate yard.

Time Spent in Empty Line-Haul

The average rail boxcar travels 55 empty miles for every 100 loaded miles. The average TOFC flatcar moves 45 empty miles for every 100 loaded miles, and the ratio for TOFC trailers is similar (6). Intercity trucks of the efficient truck lines, on the other hand, average less than 5 percent empty mileage. Two major factors affecting rail empty mileage can be readily identified. First is the large number of one-way intercity rail moves. An ongoing study for the Federal Railroad Administration is attempting to define the nationwide flows of commodities subject to modal competition (8). A review of the preliminary results indicates that one-way intercity truck flows are rare or nonexistent, but that one-way carload and TOFC flows are common. Marketing for a balanced flow when the economic unit is 13 tons is obviously less difficult than when it is 500 tons or more. But, even so, as many truck operators who use TOFC in cases of empty back-hauls have discovered, railroads generally have not attempted to balance their traffic.

A second cause of high rail empty mileage is the common practice of assigning railroad-owned cars to the exclusive use of one customer or a group of customers. A recent study of rail car terminal activity found that approximately 30 percent of all railroad-owned cars in general service are assigned to customers or car pools (5). It must be noted that unit trains, which are not included in the 30 percent figure, also frequently consist of assigned equipment. But unit trains are normally scheduled to make a complete round trip in little more time than is actually required for line-haul plus loading and unloading time. An assigned car in normal service, on the other hand, will most often travel an empty mile for every loaded mile and will potentially experience every intermediate delay, or more, on the return trip that it encounters outbound.

A third cause of rail empty return is much more difficult to quantify, although it is invariably mentioned in surveys of shipper attitudes toward rail transportation service. This is the reportedly high ratio of rail equipment in poor condition and the evidently common practice of shunting such equipment from shipper siding to shipper siding until it is finally accepted for use.

Time Spent at Origin and Destination

The 1971 study of rail car utilization referred to earlier indicated that time spent at shipper and receiver locations averages some 21 percent of the average general-service rail boxcar cycle, or approximately 6 days. (It is noteworthy, however, that the median for rail car detention is 60 hours, or less than half of the average detention.) To this must be added the time spent in carrier terminal functions: moving an empty car to the shipper for loading; moving the loaded car back to the terminal and placing it in the appropriate train; at the destination, moving the loaded car from the yard to the receiver; and returning the empty car to the yard for storage or return. The amount of time consumed in these functions was found by the same study to average about 3.5 days, with a median of 2.2 days. Add to this the time spent in empty storage, and you have an average boxcar terminal cycle of something like 365 hours per load, a TOFC car cycle of about 125 hours, and a TOFC trailer cycle in excess of 350 hours (9). These numbers contrast sharply with an average truck terminal cycle of less than 70 hours per load (10) and go far toward explaining why the average number of loads per year differs so widely among these various types of equipment.

Several major causes of longer rail car terminal cycles can be readily identified. The most obvious one is the number of steps required to handle a rail car through a terminal and the relatively large amount of time required for each step, due to the number of cars generally handled at any one time. Another major cause is the very high average allowance of nonchargeable car detention time. Even the nominal rail free time allowance of 48 hours is far more than either the 8 hours that is generally allowed for trucks or the 4 to 6 hours that is normally required to physically load or unload a car (5). But the nominal allowance applies, in fact, to less than half of all rail car placements, and normal weekend allowances raise the average allowable free time to over 85 hours. Further, this average does not reflect any effect from special detention allowances for specific industries, such as those that allow extended periods of nonchargeable time at ocean ports or that allow unlimited detention time for certain numbers of empty hopper cars at coal mines.

Several other railroad pricing practices that affect car time in the terminal area are worth discussing here. The effect of these practices on the average car cycle has never been reliably measured, but this is not necessarily the point. It is their very existence that demonstrates the extremes that have been reached in the suppression of rail capital cost considerations. That such suppression is not uniquely the fault of the railroads cannot be denied—the recent court denial of certain car time charges for cargo inspections being a case in point.

These pricing practices are referred to by a variety of terms with subtly different definitions: transit, transload, marriage, or stop-off arrangements. But they all have one very important thing in common. They all provide the shipper with more than the normal amount of car time for a modest charge, or even none at all, and always for a lower cost than would normally be charged for the same shipment moved in a direct fashion. Not only do these practices frequently ignore the extra mileage involved, which can be substantial, but they charge a rate based on a single move of a single car for shipments that can involve 2 or more cars and at least $2\frac{1}{2}$ to 3 times the normal amount of car terminal time.

UTILIZATION: ALTERNATIVE APPROACHES TO IMPROVEMENT

The traditional view of equipment problems is that there are no problems—unless there are not enough cars available to carry all the cargo proffered at any one time, in which case the need to buy more cars is apparent.

The conventional view toward service problems is that they are caused by a lack of yard throughput and holding capacity, in which case the need to build new yards is apparent.

There are many ways in which the industry can and should move to attack these problems. These include car control systems, operating strategy changes, physical improvements, and many pricing changes that reflect and encourage actual equipment cost levels. These changes, however, will take place over a long period of time, if history is any indication. These solutions will doubtless be required for many commodities. This paper, however, will deal with some alternative solutions that maximize use of current investment and minimize the need for future huge capital outlays for intermediate yards and new cars for merchandise traffic.

Loaded Line-Haul

It was pointed out earlier that one basic cause of low rail dock-to-dock speeds, and evidently the basic cause of erratic reliability, is the frequency with which cars are processed through intermediate yards. The traditional railroad approach to the intermediate yard problem, as indicated, has been to build new, more sophisticated (and generally larger) yards, in an attempt to reduce the processing time required at each yard. But the case has been made here that throughput is not the basic problem, but that with daily or twice-daily service, even the fastest intermediate yard will cause substantial line-haul delays. Two alternatives are obvious: (a) more frequent service or (b) minimizing intermediate yardings through the use of direct trains. But the first alternative would result in shorter trains, and if shorter trains are practical, then there is no reason why many or most of them could not be direct trains. This would imply that the second alternative is the one that really deserves consideration. We will return to this point in a moment, but first let us consider a larger problem (in terms of utilization).

Empty Movement and Idle Time

Three basic problems have been noted in the areas of empty movement and idle time: (a) a general failure to market for balanced directional and seasonal traffic; (b) an overeagerness to purchase special-purpose equipment for limited uses; and (c) certain traditional pricing policies that encourage a wasteful use of car time. The obvious solutions to all three of these problems are, unfortunately, highly complex and difficult to correct.

But there is an alternative. The problem of intermediate yards, we have seen, is perhaps best solved by bypassing them as often as practical. The problems of past marketing and investment philosophies might similarly be best approached by creating an entirely different rail service, with the ability to bypass existing marketing and pricing problems.

Origin and Destination Terminals

Let us now consider the problems inherent in the largest fixed block of car time, that spent at origin and destination terminals. It has been pointed out that the major problems in this area are (a) overly generous free detention time limits and (b) the large amount of time necessary to simply process a car through the yard, out to the customer's siding, and back again.

There is obviously considerable room for tightening both general and special nonchargeable detention allowances. But the same study of rail car use already referred to several times (5) found in an extensive series of shipper interviews that, although free time reductions would be tolerable, they could lead to the diversion away from rail of substantial amounts of traffic if they were not accompanied by a quid pro quo in guarantees of transit time reliability. The fact is that shippers all too frequently need all of that extra free time and more to unload cars that were shipped in a regular pattern, but arrived in unpredictable batches. Thus one approach would be for the railroads to tie the free-time allowances to transit-time consistency. Just such a proposal was made in the study referred to.

But, once again, it is tempting to suggest that the most practical solution to the problem in the merchandise area is to avoid it. Instead of giving to a customer a $20,000 boxcar to detain, give him a $7,000 trailer or two. This approach would have the added benefit of greatly reducing the average amount of time required to get a shipment through the terminal to the shipper. And it would also provide an immediate reduction in free time allowances, since the nominal free time on a TOFC trailer is a matter of only a few hours.

A NEW RAIL SERVICE: SOLUTION TO UTILIZATION PROBLEMS?

In approaching problems of both service and equipment utilization, one potential solution to at least a portion of merchandise shipments that could be envisioned is a service that might involve

1. Dedicated trains of piggyback trailers (TOFC), or perhaps containers (COFC), operating between a limited number of cities (to guarantee adequate train volume) over selected rights-of-way (to minimize maintenance expenses) and with no intermediate yards involved;
2. Terminal area responsibility for traffic balance and equipment utilization as well as sales and expenses; and
3. Entirely new tariffs, to avoid the problems of existing undesirable pricing practices.

What is envisioned, in short, is a new rail service that would combine the market orientation and equipment utilization philosophies of a good trucking operation with the high mechanical and labor efficiency of a good rail operation. But would such a service be economically viable, and in the long run would it be beneficial to the railroads and to the nation's transportation needs? A study now under way for the Federal Railroad Administration has already dealt in some depth with the former question and will deal fully with all three questions prior to its completion this year. But some preliminary results are available that indicate substantial economies. Such a service could also offer service competitiveness and, in certain cases, service advantages over trucks, without resorting to advanced equipment technology or new roadway construction.

What has been suggested here is a way in which the railroads may be able to solve both their service and equipment utilization problems. A Federal Railroad Administration study of this question is not finished, and the Federal Railroad Administration is certainly not ready to conclude that this is the way to go, but the early results are encouraging.

But this does not directly address the concerns of the trucking industry, or the opening theme of this paper, "Are the railroads the final answer in the fuel crunch?" In the short run, the railroads have the ability to absorb substantial amounts of traffic, as they demonstrated in the recent wheat sale. The point, however, is that the carriers are in the process of going broke in the midst of their prosperity. In addition, indications are that many shippers just cannot tolerate existing levels of rail service. However, if the early indications are correct, and changes are possible that will not only greatly improve service but also lower total costs, then great amounts of merchandise traffic would again appear susceptible to rail transportation.

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