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Know your Carrier's Costs? Factors Influencing LTL Motor Carriers

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ABSTRACT

Motor carriers have been analyzing their costs of doing business for many years (supposedly, there were terminal profit and loss statements in 1938!). Over the years, engineered standards have been developed and refined, and common cost drivers identified for the various functions of an LTL common carrier. Before deregulation, these standards served two purposes: 1) Profitability measures-regulated carriers could pick the niches in the rate structure which had the most profit potential and 2) Cost control-accurate engineered standards allowed careful monitoring of productivity in all areas. In a deregulated environment, these standards are also useful in setting prices (freight rates). Many of the old tariff formats are still used (especially on intrastate traffic), but the cost of specific movements is central to the new negotiating process.

This article will outline the basics of costing an LTL shipment from the motor carrier's point of view. Assigning costs to a random shipment is part science and part art. Typically, carriers attempt to determine 1) the physical resources (labor, fuel, etc.) directly required for the shipment, 2) the cost of these resources ($/hour, $/gallon), 3) any indirect costs, and 4) allocation schemes for any expenses which are joint costs. As far as physical resources go, the basic cost structure we will outline has been confirmed by individual carrier studies, consultants[1], and ICC surveys.[2] Unit costs are specific to each carrier; we will show an example of costs for a Teamster carrier in 1980, to illustrate the general level of a carrier's costs. Clerical and overhead costs are a small part of total expense, so we will merely touch on the subject. Throughout this discussion, the intent is to inform the traffic manager/negotiator and allow him to better evaluate carrier rate proposals.

I. INTRODUCTION

LTL truckers offer door to door service. This service can be divided into activities; pickup, origin dock, linehaul, breakbulk, destination dock, and delivery, plus all the necessary paperwork. Each activity has an associated cost, and a shipment's share of these costs is determined by the factors listed in Table I. For example, the pickup cost of a shipment will be a function of pieces, weight, terminal location, etc. The influence of these factors depends on the specific situation—if you are 40 miles from the terminal, stem time is an issue, if you are three blocks away, stop time may be critical. However, the research does allow some generalizations. We can examine the cost structure of the carrier activities and some typical carrier allocation procedures with these research results in mind. We hope to give the traffic manager an overview of the shipment costing problem, so that he/she can discuss rates and costs comfortably with motor carrier representatives.

II. PICKUP AND DELIVERY

LTL carriers use hourly personnel who deliver first and make pickups after their deliveries are done. Pickup and/or delivery cost is a function of driver hours and equipment cost. (For local owner-operators or others paid by piece work, the cost is usually determined by hundredweight handled or stops). The driver's time falls into four classifications—terminal time, stem time, travel time between stops, and stop time. Equipment cost can be related to driver hours and miles.

A. Terminal Time

Every driver incurs terminal time at the beginning and end of the shift, for paperwork and equipment checks. The driver must pick up his bills, check the loading of his truck, check the unit for safety, etc. Typical morning time is 15-30 minutes, depending on how current the dock is in finishing the morning loading. Evening time depends on how much cash from C.O.D.s must be checked in and how bunched the incoming drivers are. Typical evening time is also 15-30 minutes. In "combination" operations, where drivers also work on the dock, terminal time is spread over both functions and can be difficult to separate.

B. Stem Time

This is the time spent driving from the terminal to the first stop, and from the last stop back to the terminal. Like terminal time, this is a "joint cost", meaning that it is associated with the driver's total effort, rather than any particular shipment. Stem time is associated with an area, or route, and this stem time must be allocated back to individual stops and/or shipments. When a driver makes a trailer drop, his entire stem time is charged to that drop.

True stem time standards should be set taking into account congestion and road type. For example, one carrier identified four road types—city, metropolitan, suburban, and expressway.[3] These road types were then assigned different average speeds.

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Where carriers do not set standards by run, they may evaluate individual customers using an adjustment factor based on the customers' relative distance from the terminal.[4]

Academic research supports this view of stem time. Stem time increases with the population of the city served (a proxy for both congestion and distance). Major increases show up when carriers service SMSA's of 1,000,000 or more. The same studies indicate that longer haul carriers experience more stem time per stop.[5] This seems reasonable, as their market in any area is generally smaller than the short haul carriers'.

What does all this mean to the traffic manager? If he is being serviced in a large city, his carrier will likely experience 70-90 minutes stem time per run.[6] A P & D driver and equipment costs at least $23.00/hour in direct expense (see section VI.). Any shipment on the driver's run will have to absorb a share of $27.00 to $40.00 in stem time expense. On the other hand, a shipper close to a carrier's terminal could ask for a break based on his location.

C. Travel Time

Travel time is the driving time between stops on the daily run. City congestion and road type affect time between stops, but unlike stem time, travel time is sensitive to workload. If runs are stable, then travel time standards can be set by individual run.[7] Otherwise, industry practise is to set pickup and delivery time allowances by terminal location. The P and D operation is sampled for several days, and the average travel time per stop is computed for costing and production tracking purposes. Depending on the carrier, stem time may be measured by run, or made part of the average travel time per stop. Where stem time is part of the average, adjustment factors should be applied for distant customers.[8]

ICC data indicate that the carrier method is reasonable, but the terminal average procedure is oversimplified. Schuster established that travel time is a function of mileage (primarily) and stops, with some effects from city size. Mileage, in turn, is also related to stops (actually stops − 1, because of stem time) and congestion factors.[9] It appears that travel time per stop decreases as the number of stops on the run increases, and that after 20 stops, total travel time per run is constant. In other words, when the carrier's market penetration is consistent with 20¢ stops per run, additional stops are so close they do not increase the run's total travel time.[10]

What should the traffic manager make of all this?

1) Carriers costing his account are likely to charge him the terminal's average stop allowance for travel time, unless they are costing by individual run. The carrier's average travel time will be 30%-50% higher in a large metropolitan area (1MM¢) vs. a small city (250M¢). This increase parallels the increase in stem time which characterizes larger cities.[11]

2) If the carrier costs by run, travel time will be dependent on mileage and stops.[12] As the number of stops increases, the travel time per stop decreases logarithmically. A well positioned carrier should incur little incremental travel time taking on the 21st stop.

3) Average total driving time ranges from a low of 109 minutes for Central States carriers in small (100M-250M) cities to 242 minutes for Eastern Central carriers in large (5MM¢) cities.[13]

D. Stop Time

To make a pickup or delivery, the driver must get to the customer's dock, handle the shipment, clear the paperwork, and exit. Times for this function fall in two categories-a fixed time per stop and a variable time depending on the nature of the pick-up or delivery. The fixed time covers actions which have to be done at any stop-finding the customer, opening and closing trailer doors, etc. Variable time is a function of the material handling requirements of the shipment.

The attached Exhibit 1 represents productivity standards used by a major motor carrier in a large metropolitan area. The standards are not designed for costing individual shipments, but the exhibit does point out several characteristics of stop time structure. (1) There is a nearly constant allowance per stop. (2) Shipments, pieces, and weight must be specified to calculate standards, and the standards for pickups and deliveries are different. The industry employs some variation of this structure in careful stop time analyses (Galardi, Drake Sheahan, Downes).

The author could not locate definitive research in this area. Walter claimed that weight is a better predictor of stop time than pieces, but he used a limited sample, and he did not use the two together. Schuster used multiple regression to establish that stop time increases with shipment weight, but R2 was only .428, and his data did not include pieces.[14] Schuster & House indicate that stop time increases significantly as city size increases.[15] This suggests that stop times, like driving times, may have to be set by individual locations.

Exhibit 1 has some interesting implications for the traffic manager. First, he incurs at least 6 minutes stop time whenever his driver shows up. Second, if he tenders or receives more than one shipment at the same time, and if the two shipments total less than 70 pieces and 3000 pounds, his driver's standard allowance will change not at all. Third, a reasonably sophisticated carrier costing system will charge more for huge numbers of pieces on one shipment, even if the shipment is light-weight.

In summary, the P & D function has direct and indirect time components, and each of these is made up of fixed and variable portions. Stem time and terminal time are incurred whatever business the driver has, and must be allocated to each shipment. Stem time, in particular, is related to the area or run. Travel time is a function of the terminal's service area, but is primarily determined by mileage and number of stops. Stop time has both fixed and variable pieces. The variable time is a function of the pieces, weight, and shipments at the stop, and is a function of material handling requirements.

III. DOCK EXPENSE

Most LTL shipments will be dockhandled at least twice—at origin and destination—during their movement. Dock personnel can be supervised closely, and their activity (in some ways) resembles production work in an industrial setting. Engineered

Exhibit 1
P & D LTL Standards

DELIVERY								PICKUP							
Stops		Shipments		Pieces		Pounds		Stops		Shipments		Pieces		Pounds	
No.	Hr.	No.	Hr.	No.	Hr.	No.	Hr.	No.	Hr.	No.	Hr.	No.	Hr.	No.	Hr.
1	.1	1- 12	.1	1- 70	.1	1- 3500	.1	1	.1	1- 33	.1	1- 70	.1	1- 3200	.1
2	.2	13- 21	.2	71- 120	.2	3501- 6000	.2	2	.2	34- 57	.2	71- 120	.2	3201- 5800	.2
3	.3	22- 29	.3	121- 170	.3	6001- 8500	.3	3	.3	58- 80	.3	121- 170	.3	5801- 8200	.3
4	.4	30- 38	.4	171- 230	.4	8501-11000	.4	4	.3	81-103	.4	171- 210	.4	8201-10500	.4
5	.5	39- 47	.5	231- 280	.5	11001-13500	.5	5	.4	104-127	.5	211- 260	.5	10501-13000	.5
6	.7	48- 56	.6	281- 330	.6	13501-16000	.6	6	.5	128-150	.6	261- 310	.6	13001-15400	.6
7	.8	57- 64	.7	331- 380	.7	16001-18500	.7	7	.6	151-173	.7	311- 360	.7	15401-17700	.7
8	.9	65- 73	.8	381- 440	.8	18501-21000	.8	8	.7	174-197	.8	361- 400	.8	17701-20000	.8
9	1.0	74- 82	.9	441- 490	.9	21001-23500	.9	9	.8	198-200	.9	401- 450	.9	20001-22400	.9
10	1.1	83- 90	1.0	491- 540	1.0	23501-26000	1.0	10	.9	221-244	1.0	451- 500	1.0	22401-24800	1.0
11	1.2	91- 99	1.1	541- 590	1.1	26001-28400	1.1	11	.9			501- 550	1.1	24801-27200	1.1
12	1.3	100-100	1.2	591- 640	1.2	28401-30900	1.2	12	1.0			551- 600	1.2	27201-29600	1.2
13	1.4	109-116	1.3	641- 700	1.3	30901-33400	1.3	13	1.1			601- 640	1.3	29601-32000	1.3
14	1.5	117-125	1.4	701- 750	1.4	33401-35900	1.4	14	1.2			641- 690	1.4	32201-34400	1.4
15	1.6	126-134	1.5	751- 800	1.5	35901-38400	1.5	15	1.3			691- 740	1.5	34401-36700	1.5
16	1.7			801- 850	1.6	38401-40900	1.6	16	1.4			741- 790	1.6	36701-39100	1.6
17	1.8			851- 900	1.7	40901-43300	1.7	17	1.4			791- 830	1.7	39101-41500	1.7
18	1.9			901- 960	1.8	43301-45800	1.8	18	1.5			831- 880	1.8	41501-43900	1.8
19	2.1			961-1000	1.9	45801-48300	1.9	19	1.6			881- 930	1.9	43901-46300	1.9
20	2.2					48301-50800	2.0	20	1.7			930-1000	2.1	46301-48500	2.0
21	2.3							21	1.8						
22	2.4							22	1.9						
23	2.5							23	2.0						
24	2.6							24	2.0						
25	2.7							25	2.1						
26	2.8							26	2.2						
27	2.9							27	2.3						
28	3.0							28	2.4						
29	3.1							29	2.5						
30	3.2							30	2.6						

standards have been applied for many years to this area of trucking. One of the pioneers in this area is the consulting firm of A. T. Kearney, Inc.[16]

Exhibit 2 comprises pages from the Terminal Engineering Manual used by A. T. Kearney in their dock engineering studies. Kearney has identified four major factors in dock handling times—pieces (modified by weight per piece), walking distance, density (which drives piece handling time and number of carts), and shipments (there is fixed cost per shipment, especially in locating and checking the shipment). Exhibit 2 assumes a crossdock operation with four wheel carts, which seems to be the most efficient operation for terminals up to 65 doors.[17] Separate standards can also be set for forklift freight, two wheel hand trucks, drag lines, etc.

Let us determine dock time for two shipments which are identical except in their number of pieces. We assume density of 15 pounds per cubic foot (a typical density), round trip walking distance between the trailers of 70 feet (approximately 3 doors), and that the shipment takes up one dock cart. All times are in minutes, unadjusted for fatigue allowances.

FUNCTION	SHIPMENT #1 500 LB., 10 PIECES	SHIPMENT #2 500 LB., 20 PIECES
STRIP		
SHIP'T TIME	.5270/SHPT = .5270	.5270/SHPT = .5270
CART TIME	.2342/CART = .2342	.2342/CART = .2342
HDLE TIME	.177/PIECE = 1.77	.109/PIECE = 2.18
TRAVEL	.0044/FOOT = .154	.0044/FOOT = .154
STACK		
SHIP'T TIME	0	0
CART TIME	.2660/CART = .226	.2260/CART = .226
HDLG TIME	.156/PIECE = 1.56	.094/PIECE1.88
RETURN	.0042/FOOT = .147	.0042/FOOT = .147
TOTAL	4.618	5.348
15% FAT. ALLOWANCE	.693	.802
SHIP'T TIME AT 100% PRODUCTIVITY	5.311	6.150

This example shows that piece handling dominates small shipment platform times. Handling is over 70% of total dock time in this example. Doubling the piece count while decreasing weight per piece increased total time by 15%.

Although other industry sources acknowledge the accuracy of the Kearney framework, it is expensive to implement in practice. Suggested shortcuts include using min/cwt[18] or bills per hour[19] for planning and costing purposes. All alternatives require an initial dock study to account for local mix of freight, dock dimensions, etc.

Both Deming (1978) and Schuster (1977) analysed the ICC Platform Study data for dock handling patterns. Schuster found that pieces and walking distance accounted for most of the observed variation in dock handling time.[20] Deming found a logarithmic relation of dock time to weight, but did not consider pieces. Since piece count and shipment weight are directly related,[21] and Deming's model has a term for movement speed, we would argue that the two models are not inconsistent.

In summary, dock handling is primarily a function of pieces (assuming fairly average weights per piece and density), walking distance on the dock, and material handling equipment. As the example shows, there will be at least twelve to fifteen minutes dock time in any small shipment handled at both origin and destination. Shippers should get a significant benefit if they reduce the piece count on their shipment, and/or palletize their freight. Finally, palletized freight and shipments over 2000 pounds should incur less cost per piece or cwt because they are most likely handled by forklift.[22]

IV. LINEHAUL

Since LTL shipments travel together in a linehaul vehicle, the lowest level of directly measurable resource is the vehicle- mile. This means that any linehaul cost assigned to an individual LTL shipment must be an allocated cost. Carriers typically assign cwt-miles or equivalent miles to each shipment based on shipment weight, average weight per vehicle, and routing of the shipment. These allocation bases are then extended by a system- wide cost per mile or cost per cwt-mile.

The RCCC costing handbook outlines a standard allocation procedure.[23] First, one specifies the route from origin to destination, including intermediate stops at breakbulk. For example, LTL shipments from Columbus to Mattoon, Illinois might be routed through Indianapolis breakbulk rather than direct. If so, the load average from Columbus to Mattoon for costing is

Exhibit 2
Standards Workshop

STANDARD DATA

EXAMPLE OF STANDARD DATA FOR 4-WHEEL CART DOCK CROSS LOAD

ELEMENT	MINUTES	FREQUENCY
EMPTY CART INTO TRUCK	.0764	PER CART
STRIP-FIND SHIPMENT	.1600	PER SHIPMENT
STRIP-HANDLE PIECES	TABLE I	PER PIECE
CHECK - CONSTANT	.3670	PER SHIPMENT
CHECK - VARIABLE	.0770	PER CART
LOADED CART OUT OF TRUCK	.0808	PER CART
LOADED CART ACROSS DOCK	.0044	PER CART PER FOOT
LOADED CART INTO TRAILER	.1160	PER CART
STACK	TABLE II	PER PIECE
EMPTY CART OUT OF TRAILER	.110	PER CART
EMPTY CART ACROSS DOCK	.0042	PER CART PER FOOT

FORMULA DEVELOPMENT

COEFFICIENT 1	.5270 PER SHIPMENT
COEFFICIENT 2	.4602 PER CART
COEFFICIENT 3	.0086 PER CART PER FOOT
COEFFICIENT 4	TABLE I
COEFFICIENT 5	TABLE II

*Ld Avg(Cols-Ind)*Miles(Cols-Ind)¢Ld Avg(Ind-Mat)*Miles(Ind-Mat)*
Miles(Cols-Ind)¢Miles(ind-Mat)

which is the load average on each leg weighted by the mileage on each leg—the weighted lane load average. Shipment weight is divided by this load average, and the result multiplied by the miles from origin to destination. This results in equivalent miles for the shipment.

This procedure prorates capacity by shipment weight vs. average payload weight, with capacity measured in vehicle-miles. The equivalent miles are easy to calculate, and the necessary data is probably being tracked for operational purposes anyway. However, if the shipment has a lower density than the average, the cube of the shipment should be used to prorate trailer miles. Many carriers use cube instead of weight,[24] while others measure cube on selected large shipments.

This method does not treat two aspects of the linehaul function-empty miles and per trip costs. In theory, empty miles should be charged to the shipment(s) creating the imbalance. There is no agreed complicated and difficult to explain. Per trip costs are activities such as dispatcher's salary, tolls, delay time, etc. These costs are usually a small proportion of total linehaul costs, and allocating them per mile does not cause large distortions.

If a shipper has the right type of freight, or if he is shipping to the right area, he (she) can ask for rate benefits based on filling unused capacity. A ship-

Exhibit 2
B.E.S.T. DATA
Material Handling Operations

Operation Package Handling - Solid Loads Code BHPS

This element includes time to gain control of a package, slide the package from a stack, move the package to a pallet, skid, or cart, and return to the stack to handle the next package. This element includes removing packages from stacks up a level of 72 inches and placing packages on pallets, skides, or carts, up to a level of 42 inches.

These time values also apply to the operation of moving packages from a pallet, skid, or cart to a stack. The same limitations as to maximum stack height and maximum pallet, skid, or cart height apply to this operation.

These time values include time only for the manual operation of handling the packages. Typical operations covered by these time values are: unloading and loading freight cars or trailers when only one commodity is being handled.

Package/Density Pounds Per Cubic Foot	Normal Minutes Per Package — Weight - Pounds Up to and Including 5	15	25	35	45	55	65	75	85	95
			Normal Minutes Per Package							
1	.095	.144	.168	.195	.215	.256	-	-	-	-
2	.084	.120	.146	.172	.191	.230	.247	.259	.284	.300
3	.078	.106	.137	.161	.178	.216	.231	.243	.269	.285
5	.072	.097	.117	.135	.162	.202	.215	.227	.249	.265
10	.066	.087	.102	.118	.135	.177	.188	.203	.224	.242
15	.063	.082	.094	.111	.127	.156	.171	.186	.206	.220
20	.061	.079	.091	.106	.119	.151	.161	.172	.194	.210
30	.057	.075	.085	.099	.111	.141	.153	.162	.186	.192
50	.056	.070	.080	.093	.102	.133	.142	.153	.169	.182
70	.055	.068	.077	.087	.098	.128	.136	.146	.162	.172
1	.053*	-								
2	.047*	-								
3	.032**	.058*								
5	.030**	.054*								
10	.027**	.048*								
15	.026**	.046*								
20	.026**	.044*								
30	.024**	.042*								
50	.034**	.040*								
70	.024**	.039*								

* 2 @ time
** 3 @ time

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EXHIBIT 2

Operation Package Handling - Mixed Loads Code BHPM

This element includes time to gain control of a package, slide the package from a stack, orient to identify the package as required, move the package to a pallet, skid, or cart and return to the stack for the next package. This element includes removing packages from stacks up to 72 inches high and placing packages on pallets, skids, or carts up to a level of 42 inches.

These time values also apply to the operation of moving packages from a pallet, skid, or cart to a stack. The same limitation as to maximum stack height and maximum pallet, skid, or cart height applies to this operation.

These time values include time only for the manual operation of handling and identifying the packages and apply when a variety of commodities are being handled.

Typical operations covered by these time values would include unloading and loading freight cars or trailers when a variety of items are being handled.

Package/Density	Normal Minutes Per Package									
Pounds Per	Weight - Pounds Up To and Including									
Cubic Foot	5	15	25	35	45	55	65	75	85	95
1	.109	.164	.190	.221	.244	.289	-	-	-	-
2	.095	.137	.165	.195	.223	.259	.278	.292	.323	.339
3	.089	.115	.149	.173	.193	.231	.260	.274	.289	.305
5	.083	.111	.135	.155	.184	.227	.242	.256	.280	.291
10	.076	.100	.116	.135	.154	.199	.212	.229	.252	.273
15	.072	.093	.109	.127	.145	.177	.193	.210	.233	.249
20	.070	.090	.104	.121	.136	.172	.183	.195	.219	.273
30	.066	.085	.098	.114	.127	.160	.174	.183	.210	.217
50	.064	.080	.091	.107	.118	.151	.162	.174	.192	.207
70	.063	.078	.089	.101	.113	.145	.155	.166	.185	.196

Pounds Per Cubic Foot	5	15
1	.059*	-
2	.053*	-
3	.035**	.066*
5	.033**	.061*
10	.031**	.055*
15	.030**	.052*
20	.029**	.050*
30	.027**	.047*
50	.027**	.045*
70	.027**	.044*

Additional Average Time for Receiving First Piece

Each Line Item-.16 Minutes

These values contain 5% searching time included.

* 2 @ time
** 3 @ time

A. T. Kearney & Company, Inc.

Determinants of LTL Freight Cost
By Freight Handling Activity

Function	Shipment Factors	Customer Factors	Carrier Factors
Pickup ($/Shpt)	Pieces Weight Pallet?	Community Size Shpts/Stop, Spot? Customer Setup	Stop Density, Equipment Terminal Location
General Form − Terminal Time + Running Time + Stop Time + Stem Time			
Origin Handling	Pieces Weight Weight/Piece Pallet?	Size/Density Shape	Dock Layout, Equip't Load to Ride Dragline?
Linehaul	Weight Cube	Density/Shape	Equip't. Contract, Market Share/Lane
Breakbulk—same as "Origin Handling"			
Dest. Handling—Same as "Origin Handling"			
Delivery ($/Shpt)	Pieces Weight Pallet?	Community Size Shpts/Stop, Spot? Customer Setup Credit (PPD/Coll)	Stop Density, Equipment Terminal Location

ment moving in the backhaul direction (out of Florida, for example) will be traveling in a trailer that would have moved empty otherwise. The carrier benefits if he covers any of his return linehaul cost. On a smaller scale, if a shipper has light freight in an area which is a source of heavy, dense freight, this "balloon" freight rides on top of the heavy freight, amd fills space the heavy freight cannot utilize. Of course, this situation works in reverse. A manufacturer sending large shipments into consuming areas can expect higher rates, because his freight is creating empty trailers on the return trip.

V. BREAKBULK, CLERICAL, AND OTHER COSTS

There are other smaller areas of cost which a carrier incurs, but which can be considered "overhead" items.

Breakbulk costs occur when a carrier handles freight at an intermediate terminal to increase load average in the linehaul operation. This occurs regularly in the systems of long haul carriers.[25] This is a dock handling cost and appropriate standards specific to each breakbulk terminal can be developed.

Billing and rating involves converting the bill of lading into a freight bill and determining how much to charge. This is a repetitive function and can be assessed with engineered or historical performance standards.

Clerical, sales, supervision, and general office functions are indirect costs of doing business. Supervision wages and fringes is charged to the specific function, if possible. The other areas can be charged on a percent of revenue or a per shipment basis.

VI. UNIT COSTS

So far we have considered the physical units required by each function of the LTL motor carrier—hours and miles. We have not converted these units to dollars. This section will give an example assigning all costs to functions and computing typical unit costs. The objective is to give would be negotiators a "feel" for carrier cost levels. We will use system-wide average data from April, 1980 for a Teamster motor carrier. In general, non-union carriers will have a lower cost structure, while 1985 Teamster wages and benefits are higher.

The various functions break down as follows:

	P & D (per hr.)	*DOCK* (per hr.)	*LINEHAUL* (per mile)
WAGES	$12.32	$12.14	$0.33
Finges & Payroll Tax	$ 5.16	$ 4.96	$0.14
Terminal. Util.			
Dock Eqpt.	–	$ 0.94	–
Transport Eqpt. (Deprec., Fuel, Maintenance)	$ 4.75	–	$0.58
Direct Super.	*$ 0.66*	*$ 1.89*	*$0.02*
TOTAL	$22.89	$19.93	$1.07

Costs related to billing, claims, sales, and terminal and general office overhead added 18.5% to this carrier's total expense. For this shorthaul carrier, dock and P & D expense was 57.5% of all expense, and linehaul was 24%.

One can also divide trucking operations into the revenue generating function-the Pickup and Delivery operation-and the support functions-all others. On that basis, this carrier incurred expense of $72.24 per P & D hour. For this particular carrier to break even (which happened in April, 1980), each driver had to pick up and/or deliver approximately $600.00 in freight charges during an eight hour day.

VII. SUMMARY

The major functions of the LTL motor carrier—pickup and delivery, dock, and linehaul—have been studied frequently. Both carriers and consultants have isolated the cost structure of these activities to set productivity standards; public studies, in general, have agreed with the industry's findings. Carriers have used these standards to assign cost to individual shipments.

This paper has outlined the major cost factors for these activities. Many of these costs are "joint costs." We have tried to point out some carrier approaches to the allocation of these joint costs and compared this approach to public domain studies.

This paper is an attempt to demystify LTL costing so that a traffic manager can negotiate intelligently with carriers. Handling time increases with pieces. Stop density is a key factor in P and D cost, and there is a fixed cost per stop. These and the other facts presented here are meant to inform the rate negotiator and give all parties common ground to start from.

All allocation schemes are arbitrary to some extent. Each carrier will approach costing differently, and each carrier's structure (network, market share, labor cost) will dictate a different set of costs. In this era of deregulation, a carrier is free to price according to his costs, while a customer can negotiate his own deal. If both sides start from similar ideas about what it takes to "pick it up, put it on the truck, and deliver it," there is a better chance for an equitable bargain.

ENDNOTES

1. A. T. Kearney, Inc. has done extensive work in both dock and P & D standards. See their Terminal Engineering Manual, Effect of Shipment Weight on Dock Handling Labor(1969),and Effect of Piece Weight and Density on Dock Handling Labor Time(1970).
2. Schuster(1977) is an indepth analysis of ICC platform and p & d studies. This paper draws heavily on that work.
3. Downes and Lutz, Computerized driver productivity analysis, Terminal Operator, Sept/Oct, 1978: 9.
4. Temple, Barker & Sloane, Inc., A Carrier's Handbook for Costing Individual Less-Than-Truckload Shipments, p. 77.
5. Schuster, An econometric analysis of motor carrier less-than- truckload transportation. unpublished Ph. D. thesis. Ohio State University, 1977; p.408. Akanbi, An investigation into the performance of activities of the motor common carrier industry. unpublished Ph. D. thesis. Ohio State University, 1976: p. 93.
6. Schuster, op. cit., p.408.
7. Temple, Barker & Sloane, op. cit., p.124.
8. Ibid., p. 77.
9. Schuster, op. cit., pp. 683, 689.
10. Ibid., p. 675.
11. Schuster, A. D., and R. House. An analysis of the determinants of pickup and delivery cost. Proceedings, Transportation Research Forum. 19: p. 392.
12. Drake Sheahan/Stewart Dougall, Inc. Effective Truck Terminal Planning and Operations. The Operations Council. 1980: p. 93.
13. Schuster and House, op. cit., p. 392.
14. Schuster, op. cit., pp.218-222.
15. Schuster and House, op. cit., p. 392.
16. See "Use of Standards in Controlling Dock Terminal Costs," a presentation by A. T. Kearney to the Operations Council and to the NAFC, May, 1956.
17. Drake Sheahan, op. cit., p. 22.
18. Temple, Barker & Sloane, op. cit., p. 59.
19. Drake Sheahan, op. cit., p. 57.
20. Schuster, op. cit., p.176.
21. Ibid., pp. 588-589

22. Ibid., p. 592. Schuster shows that over 50% of shipments over 2000 pounds are handled by forklift.
23. Temple, Barker & Sloane, op. cit., pp. 62-74.
24. Ibid., p. 127.
25. Schuster, op. cit., pp. 196-197. In the ICC Platform Study of 1973 Eastern Central carriers indicated that the average shipment in weight brackets under 1000 pounds received a breakbulk transfer a mean of 2¢ times.

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