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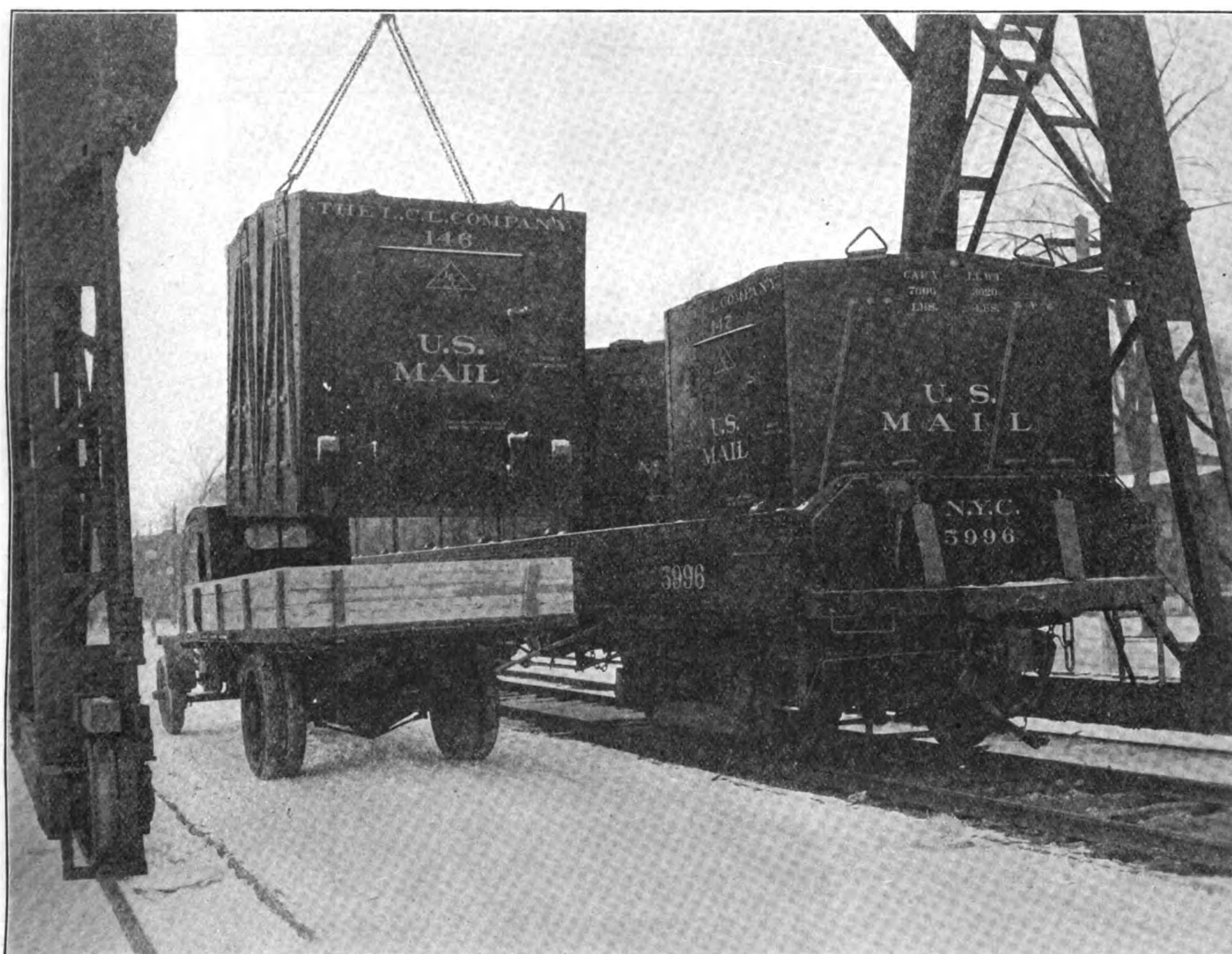
Container Car Freight Service on the New York Central

In the December, 1921, issue of RAILWAY AND LOCOMOTIVE ENGINEERING there appeared an article under the title of Avoidable Waste in Car Operation, a description of the container cars which were introduced in mail service on the New York Central. A new system of freight shipping by "container cars," which cuts manual labor to a minimum was described in detail by F. S. Gallagher, engineer of rolling stock, before the Society of Terminal Engineers at New York, Oct. 10, 1922, from which we extract the following:

The "containers" have been used regularly in carrying United States mail for over a year without any loss or damage whatever to valuable consignments; have reduced necessity of sacking mail and have greatly expedited inter-city deliveries. The "containers" permit a shipper to stow consignments on his own shipping platform and eliminate need of costly boxing and crating.

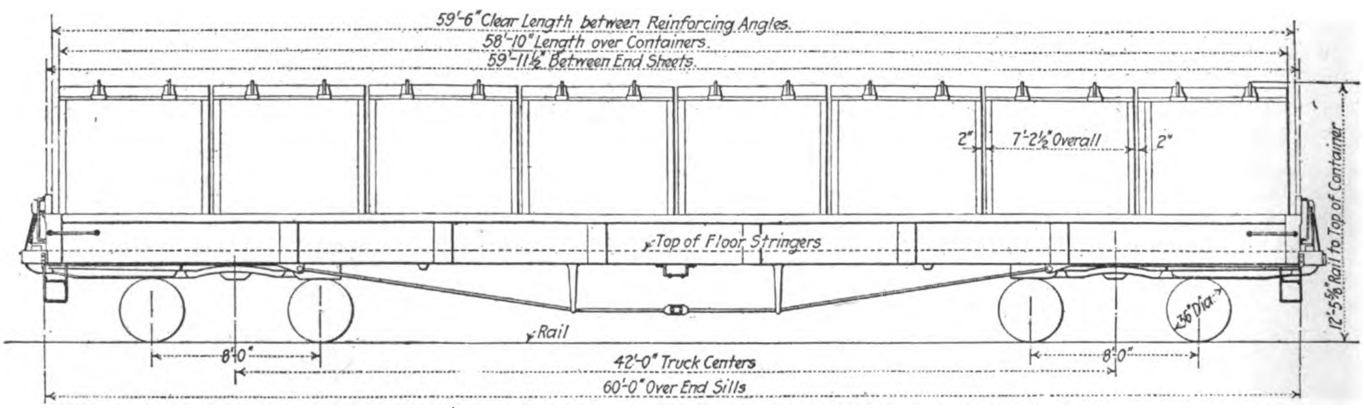


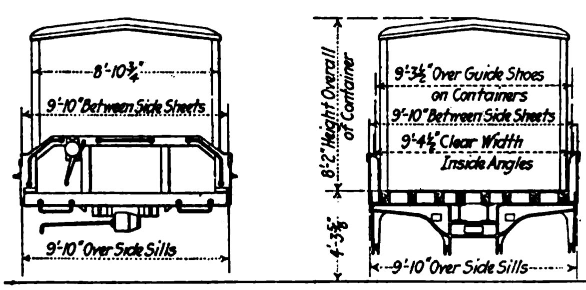
TRANSFERRING CONTAINER FROM CAR TO MOTOR TRUCK ON THE NEW YORK CENTRAL

The successful tests of the "container"

cars in carrying express and mail matter have now been followed by the establishment of crane equipment for regular "container" service in carrying less-than-carload freight between 33rd Street Station, New York City, and Carroll Street Station, Buffalo, N. Y., the "container" cars leaving each terminal Tuesdays and Saturdays. Special rates have been established under tariffs published with the approval of the Interstate Commerce Commission. These provide rates for a minimum of 3,000 pounds up to the maximum capacity of a 7,000-pound load for each container.

Mr. Gallagher, in describing the new system before the Terminal Engineers' Society, said in part:





GENERAL ARRANGEMENT OF IMPROVED TYPE OF MAIL CONTAINER CAR

"Although the container system of handling less-than-carload freight is too young in years to furnish definite or concrete figures as to costs, we are able to show success in economy and safety effected through the new method. The accomplishment of a means of loading or unloading a car of less-than-carload lots of freight within a few minutes alone carries far-reaching potential benefits, when we take into consideration the railroad equipment of the country and the inability of the railroads to control this equipment during the peak load of business. In times of heaviest demands, it is known that shippers, while waiting for a change in the market, gladly pay the regulation demurrage charges rather than unload the car in which their goods were shipped, using the car as a temporary storage place, and tying up equipment that is badly needed. This condition was very prominently brought out during the war when goods were shipped, especially in this eastern district, to consignees who either could not or did not want to unload the freight, but instead took advantage of the demurrage provisions, which was at an expense to the railroad company for car revenue which they would have had if the car had been unloaded promptly and returned to service, and at the expense of the public at large because of the inability of the railroads to handle greater tonnage because of the lack of equipment.

"This condition with the use of the less-than-carload containers should be greatly reduced, if not altogether eliminated, because of the fact that the containers can be removed from the car, immediately taken to the shipper's warehouse, and while there might at some day be a demurrage charge for holding the containers, it would not keep the rolling stock out of service. In other words, the container method of handling freight permits the enforcement of quick unloading, and of course the quick unloading means the quick return to service of the car. During periods when there is a shortage of cars, the quick unloading of the freight car is a benefit to all concerned—the railroads, the shipper and the public.

"The saving in labor and time may be seen by noting, in detail, the number of times that less-than-carload lots of freight must be handled from the shipper to the consignee. Let us follow one package from start to destination: First, it is carried from the packing room to the warehouse platform; second, from the warehouse platform to the wagon by hand truck; third, from the hand truck into the wagon. This is man-handling. The wagon then proceeds to the freight house, where at the platform occurs the next man-handling. The fourth man-lift is from the wagon to the freight house platform, and the fifth from the platform to the hand truck. The individual package must be weighed, proper records made, and then taken into the car, making the sixth movement. A seventh handling is the stowing into the freight car, after which is attached the seal, which is broken at destination. The eighth handling is by the unloader lifting the freight to the floor of the car for the hand trucker; the ninth, the hand trucker with the package stopping while record is being made of the shipment going out of the car. The trucker then carries this freight to a designated place in the freight house and it is left there.

"The consignee is notified that the goods for him have arrived, sends his wagon to the freight house, and notifies the delivery clerk. The delivery clerk points out the shipment to the hand trucker, who takes it to the wagon for loading, which is the tenth handling. When the package is delivered by the hand trucker to the wagon platform, it is dumped at the tail gate of the wagon, making the eleventh handling, and must be handled the twelfth time to place it into the wagon. At the consignee's receiving platform, the goods must be unloaded from the wagon, making the thirteenth time that this package has been handled.

"Now assuming that a carload of less-than-carload freight were 20,000 pounds, this means that it must be man-lifted thirteen times, or man-power must be provided to lift 260,000 pounds in order to transfer one carload of 20,000 pounds of freight. This does not include the numerous checkings and records that must be made of this freight, which in itself is a big item of expense.

"By the new system, the container is delivered to the shipper, who, if properly equipped, will have a light overhead crane or some other means of carrying the container into his warehouse, so that one handling of the original package into the container is all that is necessary. The expense of crating is eliminated. When the goods are in the container, the door is closed, and if the shipper desires, he can put his own lock on it. The railroad company would also seal the container with the regular seal used on car doors.

"Being loaded with one handling of the freight, the container is lifted by hoist from the floor of the shipper's warehouse to the motor truck and is lifted by hoist from the truck to the car.

"Particular attention is directed to the security of the shipment when placed on the car. The bottom of the door of the container sets in behind the side of the car, making it possible to get into the container while on the car, and the container is big enough so that it cannot easily be taken from the car without proper lifting facilities.

"At destination, the operation described is reversed. The container is lifted by crane from the car onto the motor truck and then from truck to the consignee's platform, where it is unloaded and may be ready for a return shipment, or it may be picked up by truck for the use of some other shipper. While the container is being unloaded, the motor truck, as well as the railroad car, is released for service.

"The containers are 7 feet wide, 9 feet long, and 8 feet high, and they have a carrying capacity of 7,000 pounds. This keeps the gross weight within the carrying capacity of a five-ton truck. The containers are made of steel throughout, except the floors, which are of laminated wood. They are well braced, and there is very little chance of damage with ordinary handling." Each weighs 3,020 lbs., and has capacity for 438 cubical feet.

The Cost of Stopping a Freight Train

An Analysis of a Method Followed in Making an Estimation

To ask what it costs to stop a freight train and accelerate it to the speed from which the stopping started is about like asking the size of a piece of chalk. It depends. It depends on the track—whether straight, curved or on a grade; the length and weight of the train, the locomotive and even on the weather.

It would be so exceedingly difficult to actually make a test, that possibly the nearest approach to the answering of the question is to assume conditions and work out a theoretical case that is as close to practical operation as possible.

The problem is an attractive one, even though it may resemble the setting up of a man of straw.

With this apology for rushing in, where experts might fear to tread, an offering may be made.

Let us assume that the track is level, straight and in good condition. For a train, we will take one of 75 cars weighing 11,121,000 pounds, hauled by an engine with 29½ in. by 32 in. cylinders and having drivers 63 in. in diameter, and with a boiler pressure of 200 lbs. per sq. in. Such an engine would weigh about 398,000 lbs. of which 306,000 lbs. would be on the drivers, while the tender would weigh about 223,000 lbs., making a total of 621,000 lbs. All this is necessary because it is this weight that must be stopped as well as accelerated to speed again.

Then there must be an assumption as to train resistance which if we put it at 6 lbs. per ton for the cars and 8 lbs. per ton for that of the locomotive and tender gives us a total resistance of 35,605 lbs. which is regarded as constant.

In order to include as many of the variables entering into the cost as possible, we will assume, for the engine, a rate of evaporation of 5 lbs. of water per pound of coal, which costs $3.00 per ton. For the steam at a pressure of 200 lbs. per sq. in., the weight will be 47 lbs. per cu. ft. Further it will be assumed that full boiler pressure is maintained in the cylinders up to the point of cut-off. For an acceleration to different speeds, different points of cut-off will be used as the speed increases. For example the reverse lever would be set to cut-off at 89 per cent. of the stroke from the start to a speed of 5 miles per hour. From that to 10 miles per hour two points of cut-off are assumed; one at 89 per cent. and the other at 80 per cent. of the stroke. The former would probably tax the boiler pretty well up to its limit, while the latter would more nearly approach that used in service, but would require a longer time and greater distance in which to accelerate to speed.

Similar assumptions are made for the acceleration from 10 to 15 miles per hour, where estimates are based on cut-offs of 87 and 70 per cent. respectively.

In this estimate it is assumed that the train is running at speeds of 5, 10 and 15 miles an hour; that it is stopped and again accelerated to the speed from which it has been stopped.

In making the stop consideration has been paid to the possibilities of practical brake applications. That is we have taken about a 6 lb. brake-pipe reduction which will give about 15 lbs. brake cylinder pressure, and this developed on each of the 75 cars and the tender with an assumed coefficient of friction of .20 for the brakeshoes will give an actual brakeshoe resistance of about 1.312 per cent. of the weight of the train.

The reason for using this low reduction is that it is desired to make a single reduction stop and a greater reduction would probably cause train trouble.

There are two further brake assumptions which are, first, that it will take 12 seconds for the serial propagation of the appliaction from the engine to the rear car and, second, that, after the train has stopped, it will require 60 seconds in which to release the brakes so that the train can start.

The problem, then, becomes that of calculating the time and distance required to stop and accelerate to speed with the cost; and also the same as involved in running that same distance at the original speed.

It appears that there are five items of cost in this: Wages, brakeshoes, water, coal and wear and tear.

The method of determining these costs can be best followed by a reference to the accompanying table.

The first line gives the speeds of the train in feet per second and needs no explanation. Likewise the second line, which is a repetition of the assumption of the points of cut-off at which the engine is to be worked during the period of acceleration.

From the several points of cut-off the mean effective pressures in the cylinders was obtained and from these the tractive efforts as shown in the third line.

We have already assumed a constant train resistance of 35,605 lbs., and by subtracting this from the several gross tractive efforts we obtain the tractive efforts available for acceleration as given in line 4.

Dividing these "available tractive efforts by the total weight of the train, we get the percentage of the weight of the train as represented by the tractive effort available for acceleration, as given in line 5.

We have assumed that it takes 12 seconds for a brake application to reach the last car. As far as brake resistance is concerned this is taken as equivalent to an instantaneous brake application throughout the train at the end of 6 seconds. The train is, therefore, assumed to be drifting for 6 seconds under the influence of its own resistance which is 0.303 per cent. of its weight. Under these conditions the speeds of the train will have been reduced to those given in line 6 at the end of 6 seconds, and will have traversed the distances given in line 7 during that time.

Then the brakes are assumed to start their work, and together with the internal resistance of the train itself will have stopped it in the distances given in line 8 and in the times given in line 9.

If we add the distances in lines 7 and

8 together, we have the distances traversed to the stop; and, by adding 66 to the times in line 9 we will have the time elapsed from the start of stopping to the start; 6 seconds being for the period of drifting and 60 for that of standing to release.

If on the start the tractive effort available for acceleration as given in line 4, is applied to the train it will be brought back to its original speed in the time given in line 10 and in the distance given in line 11.

By adding the time required for stopping and standing to the time in line 10, we will have the time given in line 12 to stop, release brakes and accelerate to speed. And by adding together the distances given in lines 7, 8 and 11, we have the total distance traversed from the start ing and standing being given in line 16.

This covers all of the items of stopping, standing and acceleration except brakeshoe wear.

One more assumption as to locomotive cut-off and that is that one of 58 per cent. of the stroke be used to carry the train over the distances involved at the original speeds.

A process similar to that already used will give us the time required to traverse the distance by dividing line 13 by line 1. This is given in line 17. Knowing the number of wheel revolutions required we readily obtain the steam consumption given in line 18, and from it by dividing by 5 the coal consumption of line 19.

With this we have all of the elements then, assumed that the wear of the shoes is at the rate of .047 lb. per 1,000 feet, by which the brakeshoe wear given in line 23 was calculated.

In order to determine the extra wages paid for the stop those paid the various members of the engine and train crews were taken to be as follows:

Engineer	$1.00 per hour
Fireman	.77 per hour
Conductor	.80 per hour
Two brakemen @ .69.....	1.38 per hour
Total	$3.95 per hour

Then taking the extra time used on this basis we get the extra cost of wages given in line 25. The cost of brakeshoes is taken at 2.7 cents per pound, and gives the

		Speed in Miles Per Hour				
		5	10	10	15	15
1	Speed in feet per second	7.33	14.66	14.66	22.00	22.00
2	Cut-off for acceleration in per cent. of stroke	89.00	89.00	80.00	87.00	70.00
3	Tractive effort in lbs.	75150.00	68510.00	54800.00	61880.00	47780.00
4	" " available for acceleration in lbs.	39545.00	32905.00	19195.00	26275.00	12175.00
5	Ratio of available tractive effort to weight of train in per cent.	.337	.28	.129	.224	.104
6	Speed of train after drifting 6 seconds in feet per second	7.27	14.60	14.60	21.94	21.94
7	Distance drifted in 6 seconds in feet	43.80	87.78	87.78	131.82	131.82
8	" to stop from drifting speed in feet	50.83	204.95	204.95	454.92	454.92
9	Time to stop from drifting speed in seconds	14.00	28.05	28.05	59.50	59.50
10	" to accelerate to speed seconds	65.80	147.63	242.54	249.42	461.77
11	Distance to accelerate to speed feet	241.45	1136.77	2008.85	3002.07	6155.26
12	Time to stop and accelerate to speed, seconds	145.80	241.68	336.59	374.92	586.27
13	Distance to stop and accelerate to speed, feet	336.08	1429.50	2241.85	3588.81	5669.68
14	Steam used to accelerate, lbs.	315.28	1484.58	2394.59	3866.54	5550.38
15	Coal used to stop and accelerate, lbs.	67.06	301.65	483.60	779.88	1116.35
16	" " while drifting and standing, lbs.	4.00	4.74	4.74	6.27	6.27
17	Time to run distance at speed, seconds	45.83	97.46	152.90	163.13	257.71
18	Steam to run distance at speed, lbs.	149.52	635.94	997.21	1596.60	2522.17
19	Coal " " " " " "	29.90	127.19	199.44	319.32	504.43
20	Extra time used to stop, seconds	99.97	144.22	183.69	211.79	328.56
21	" steam " " " lbs.	165.76	848.64	1397.08	2269.94	3028.21
22	" coal " " " "	38.16	174.47	284.16	460.26	611.92
23	Brakeshoe wear lbs.	1.08	7.25	7.25	14.88	14.88
24	Extra cost for wages	.11	.16	.20	.23	36
25	" " " brakeshoes	.03	.20	.20	.40	.40
26	" " " water		.01	.01	.02	.03
27	" " " coal	.06	.26	.43	.69	.92
28	" " " wear and tear	.04	.06	.08	.10	.16
29	" " " stopping	.24	.69	.92	$1.44	$1.87

TABLE OF COSTS FOR STOPPING AND ACCELERATING A TRAIN

of the stop to the recovery of full speed as given in line 13.

Knowing the distance traveled during the period of acceleration and the rates of cut-off used from the start to the attainment of full speed, and assuming full boiler pressure to be maintained to the point of cut off, and that there is a clearance of 1.5 per cent for the cylinder, then, with the steam weighing .47 lb. per cu. ft. it is possible to calculate the steam consumption for the period of acceleration as given in line 13. If the evaporation is at the rate of 5 lbs. of water per pound of coal, and if the consumption during drifting, retardation and standing is at the rate of 3 lbs. per minute, we will have the coal consumption given in lines 15 and 16. The consumption during drifting and standing being given in line 16. involved in the stopping, accelerating and running of the train. It only remains, then, to determine the difference between the two performances in order to learn the extra cost of stopping over that of running the train over the distance covered. By subtracting line 17 from line 12, we have the extra time occupied in making the stop as given in line 20. By subtracting line 18 from line 14 we have the extra amount of steam consumed, given in line 21. By subtracting line 19 from line 15 we have the weight of the extra coal consumed as given in line 22.

The distance that the brakeshoes were running in contact with the wheels is obtained by multiplying the distances given in line 8 by 608, or the total number of brakeshoes on the cars and tender. It is, cost in line 26. Water is assumed to cost 8 cents per thousand gallons in the tender, which on the basis of the extra consumption of line 21, gives the cost in line 27. Coal is taken at $3.00 per ton, and gives the cost of line 28. Then there is an assumption of wear and tear based on a life of seventeen years for the rolling stock with cars costing $1,500 each and the locomotive $60,000. This is placed in line 29, and the total of lines 24 to 28 is the calculated cost of stopping a train and again accelerating it to speed with only sufficient delay to release the brakes; a delay that is here placed at the minimum.

It cannot, of course, be claimed that this calculation gives results that cover the actual costs but it is probably a fairly close approximation. There are so many