# THE RAILWAY & SHIPPING WORLD,

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AN ILLUSTRATED PERIODICAL DEVOTED TO STEAM AND ELECTRIC RAILWAY, SHIPPING, EXPRESS, TELEGRAPH & TELEPHONE INTERESTS.

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The Canadian Roadmasters' Association.
The Canadian Ticket Agents' Association.

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NEXT ANNUAL MEETING at Hamilton, Oct. 16, 1901.



wind storms, etc. (See table 4 on page 69). A statement (see copy of such report covering Havelock section, Nov. 1, 1900, in table 5 on page 71) for the 24 hours ended midnight is made up & sent the general superintendent by first mail showing each freight train run in the direction of balance of tonnage—between what stations, number of engine, class of rating, schedule load at that class of rating, tare, contents, actual & equivalent tonnage & particulars of any doubling or assisting. The percentage of total equivalent tonnage taken over the ruling grade on each section to total of loads which, according to schedule & class of rating, should have been taken over that ruling grade by the power on that day is calculated, & the percentage performance on the different sections tabulated for comparison. If an engine doubles or is assisted over the ruling grade the superintendent is debited with what the engine can take over the next heaviest grade.

The foregoing paper was read by Mr. Tait before a recent meeting of the New York Railroad Club, at which 1st Vice-President W. W. Wheatly presided. The reading of the paper was followed by a very important discussion.

The CHAIRMAN said:—There is probably no subject in connection with freight transportation on our railways which in recent years has excited more discussion & interest than the matter of rating freight engines according to tonnage. This is a matter which interests not only the transportation officer, but also the head of the locomotive department. I think we should have a discussion this evening without it being necessary for me to call upon members by name. As no one has been selected to open the discussion, the field is free for any one who chooses to speak first.

A. E. MITCHELL—I notice that the author has mentioned the old method without stating what it was. I would be glad if he would tell us what his old method was when he adopted the new.

The CHAIRMAN—I have no doubt that there will be a great many questions asked Mr. Tait to-night, & I suggest that he make a note of them as they are propounded, & he will be given an opportunity later to reply to them all. Will some one open the discussion? We would be glad to hear from Mr. Daly, of the Lackawanna road.

J. M. DALY—I came here more to learn about tonnage than to talk about it. But there are one or two points I would like more information on as regards this chart. It strikes me that the chart provides for a reduction on the ratio of 13 to 10 of loads against empties regardless of the number of empties you have on the train. In other words, if you are pulling up a grade 90 ft. to the mile, it is more easy to handle the full rating of empties than it would be if you are undertaking to pull them up a grade of 45 ft., by reason of the length of train & gradient resistance. So that it struck me that the longer the train or the greater the tonnage assigned a train, the greater should be reduction for empties hauled. Another question that I wished to ask is what provision is made for busy tracks? For instance, on a portion of our line we have 20 first-class trains in each direction each 24 hours, & from 5 to 7 fast freights, with a grade of about 45 ft. to the mile for 24 miles. Now, if we confined the movement of trains to 7 miles an hour it is going to utilize that track with freight trains the greater portion of the time. Another feature that struck me was in the testing arrangements. If on a favorable day, with an engine that the master mechanic knew was good, & a choice engineer, good fuel, favorable conditions, he hauled 1,000 tons, what reduction from that was arbitrarily made in rating the engines to insure the general run of engines hauling tonnage up the same grade during the busy season, when the power is more or less overtaxed & run down, & when new enginemen & firemen are pressed into service that are not as competent as the average run of enginemen & firemen that are utilized in testing? It appears to me there is as much danger in undertaking to rate your engines too high & as much money lost in overtime as in underestimating them a little, especially on busy pieces of track where you have a heavy passenger service & a heavy high-class freight service.

F. F. GAINES—As I understand the matter, this sliding scale is made on a basis of either light & loaded cars or partially loaded cars. Now, there is another case that may come up, & I would like to know what provision would be made for it. For instance, I have here a record of two different trains, both handled by the same engine; one was made up of 100,000 lbs. capacity cars, the other was of old-style 60,000 lbs. capacity cars. The tare in the 100,000 lbs. car train was 676 tons; the net tonnage was 1,824 & the gross tonnage 2,500. With the 60,000 lbs. cars the tare was 619, the net 1,381, & the gross tonnage 2,000. By comparing those figures, the net tonnage of the 100,000 lbs. cars is 24.2% greater than the 60,000 lbs. cars. The gross tonnage is 20% greater in those 100,000 lbs. cars than in the 60,000 lbs. What kind of provision would be made for cases of that kind? We all have more classes of cars than one on our roads. It takes more power to haul one class of cars than it does another, & I wish to know if this scale provides for any feature of this kind.

The CHAIRMAN—I think it would perhaps facilitate the discussion if Mr. Tait were permitted now to reply to the questions that have been asked & the points that have been raised & also to elaborate slightly upon the paper.

Mr. TAIT—This paper is, as you will have seen, only a brief description of a method of rating & loading engines which we have had in effect since Oct. 1. Prior to that date we had about the same system of rating engines for the different weather & other conditions as we have now, but we were loading them then on what I have called the "actual" tonnage basis; that is, the actual weight only was counted, whether a car was loaded with only one ton or to its full capacity. The only exception was in the case of an entirely empty car, to the weight of which an arbitrary addition was made. When we said that under the old system an engine was capable of taking 900 tons over a grade, that meant 900 tons in loaded cars, whether loaded light or to their full capacity. This, I think, answers Mr. Mitchell's inquiry.

The comparison between our old & our new system might be summed up in a question. When you say that an engine will take 900 tons over a certain grade, what kind of tons do you mean? Do you mean 2 to 1 tons; that is, 2 tons of contents to 1 of tare? Or do you mean 3 to 1 or 1 to 1? It makes a great difference. For example, let us take a train of dressed beef. We will say that the load for the engine is 900 tons. The cars will average, say, 15 tons, & the beef & ice, say 15 tons, or 1 to 1. Each car with contents will weigh 30 tons, & 30 cars will make the 900 tons. Now convert the beef into grain, in cars of 30 tons capacity. We still have the car weighing, say, 15 tons, but we have 30 tons of a load in each car, or 2 to 1. Each car with contents will weigh 45 tons, & we will get our 900 tons in 20 cars instead of in 30 cars. Which will pull the easier? The beef or the grain, each weighing 900 tons? There can be no question about that. Any engineman will tell you he would prefer to pull the grain (the 2 to 1 train). What does this mean? It means that if the engine can take 900 tons in the beef train (1 to 1), it can by reason of the smaller percentage of tare take a greater tonnage in the grain train (2 to 1). Our method is devised to take care of this; to profit by the large capacity car fully or well loaded (small percentage of tare), & on the other hand, in the case of a train having a high percentage of tare, to prevent the overloading of engines.

The first proposition I advance is this, that the haulage capacity of engines should be based on a uniform proportion of tare weight to gross weight behind the tender. In order that the relative haulage capacity of the different classes of engines may be determined on any given grade the test should be made with the same kind of a train. If not the identical cars, the percentage of tare should be the same. Otherwise the comparison is

TABLE 1.—HAVELOCK SECTION.

HAULAGE CAPACITY (IN TONS) OF LOCOMOTIVES ON FREIGHT TRAINS THE TARE WEIGHT OF WHICH IS 33⅓% OF THE GROSS WEIGHT BEHIND THE TENDER.

EAST BOUND.

| FROM | 153 | 145 | 140 | 120 | 115 | 110 | 105 | 100 | 95 | 90 | 85 | 80 | 70 | 65 | 60 | 55 | 50 | % ENG. CAP. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Havelock | 1968 | 1865 | 1800 | 1513 | 1479 | 1415 | 1350 | 1286 | 1221 | 1157 | 1092 | 1028 | 900 | 836 | 772 | 707 | 613 | |
| Central Ontario Jct | 1241 | 1176 | 1135 | 973 | 932 | 892 | 851 | 811 | 770 | 730 | 689 | 649 | 568 | 527 | 487 | 446 | 406 | |
| **Tweed** | **1063** | **1008** | **973** | **834** | **799** | **765** | **730** | **695** | **660** | **625** | **591** | **556** | **486** | **452** | **417** | **383** | **348** | **Controlling Grade.** |
| Kaladar | 1143 | 1083 | 1046 | 896 | 859 | 822 | 781 | 747 | 710 | 672 | 635 | 598 | 523 | 486 | 448 | 411 | 374 | |
| Mountain Grove | 1175 | 1114 | 1075 | 922 | 883 | 845 | 806 | 768 | 730 | 691 | 653 | 614 | 538 | 499 | 461 | 422 | 384 | |
| **Sharbot Lake** | **1063** | **1008** | **973** | **834** | **799** | **765** | **730** | **695** | **660** | **625** | **591** | **556** | **486** | **452** | **417** | **383** | **348** | **Controlling Grade.** |
| Maberley | 1273 | 1206 | 1165 | 998 | 957 | 915 | 874 | 832 | 790 | 749 | 707 | 666 | 582 | 541 | 499 | 458 | 416 | |
| Perth | 1405 | 1331 | 1285 | 1102 | 1056 | 1010 | 964 | 918 | 872 | 826 | 780 | 734 | 643 | 597 | 551 | 505 | 459 | |

WEST BOUND.

| FROM | 153 | 145 | 140 | 120 | 115 | 110 | 105 | 100 | 95 | 90 | 85 | 80 | 70 | 65 | 60 | 55 | 50 | % ENG. CAP. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Smith's Falls | 1633 | 1547 | 1491 | 1280 | 1227 | 1174 | 1120 | 1067 | 1014 | 960 | 907 | 854 | 747 | 694 | 640 | 587 | 531 | |
| Perth | 1121 | 1063 | 1026 | 880 | 843 | 806 | 770 | 733 | 696 | 659 | 623 | 586 | 513 | 476 | 440 | 403 | 367 | |
| Bathurst | 1134 | 1074 | 1037 | 889 | 852 | 815 | 778 | 741 | 704 | 667 | 630 | 593 | 519 | 482 | 445 | 408 | 371 | |
| Sharbot Lake | 1189 | 1127 | 1088 | 932 | 894 | 855 | 816 | 777 | 738 | 699 | 661 | 622 | 544 | 505 | 466 | 427 | 389 | |
| Mountain Grove | 2006 | 1901 | 1835 | 1573 | 1508 | 1442 | 1377 | 1311 | 1245 | 1180 | 1114 | 1049 | 918 | 852 | 787 | 721 | 656 | |
| Ardendale | 1121 | 1063 | 1026 | 880 | 843 | 806 | 770 | 733 | 696 | 659 | 623 | 586 | 513 | 476 | 440 | 403 | 367 | |
| Kaladar | 1640 | 1554 | 1501 | 1286 | 1233 | 1179 | 1125 | 1072 | 1019 | 965 | 912 | 858 | 750 | 697 | 643 | 590 | 536 | |
| Hungerford | 1461 | 1385 | 1337 | 1146 | 1098 | 1051 | 1003 | 955 | 907 | 860 | 812 | 764 | 669 | 621 | 573 | 525 | 478 | |
| **Tweed** | **995** | **943** | **910** | **780** | **748** | **715** | **683** | **650** | **617** | **585** | **553** | **520** | **455** | **422** | **390** | **358** | **325** | **Controlling Grade.** |
| " | *1120* | *1061* | *1025* | *878* | *842* | *805* | *769* | *732* | *695* | *659* | *622* | *586* | *512* | *476* | *439* | *402* | *366* | |
| Ivanhoe | 1031 | 977 | 914 | 809 | 775 | 741 | 708 | 674 | 640 | 607 | 573 | 539 | 472 | 438 | 404 | 371 | 337 | |
| " | *1163* | *1102* | *1064* | *912* | *874* | *836* | *798* | *760* | *722* | *684* | *646* | *608* | *532* | *494* | *456* | *418* | *380* | |
| Central Ontario Jct | 1224 | 1160 | 1120 | 960 | 920 | 880 | 840 | 800 | 760 | 720 | 680 | 640 | 560 | 520 | 480 | 440 | 400 | |

TABLE 2.—INDEX TO HAULAGE CAPACITY AND DESCRIPTION OF LOCOMOTIVES.

| Per Cent. Capacity. | Type of Locomotive and Individual Numbers. | | | | | | | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | EIGHT WHEEL COUPLED | | SIX WHEEL COUPLED | | | FOUR WHEEL COUPLED | | SWITCHERS | | |
| | CONSOLIDATION | | TEN WHEELERS | | MOGUL | ATLANTIC | EIGHT WHEELERS | SIX WHEEL | Road | Switch |
| | Simple | Compound | Simple | Compound | Simple | Compound | Simple | Simple | | |
| | | | | | | | | | 7<br>111 | |
| 153 | 732/738 | | | | | | | 342/344 | 5 | 3 |
| 145 | 739/740 | 669/731, 741/786, | | | | | | 336/341, 580/584, 614 | 13 | 12 |
| 140 | 316/320 | | | | | | | 321/335 | 8 | 15 |
| 120 | 312/315 | | 200/202 | 194/199 | | | | | 22 | |
| 115 | 497/498 | 499/504 | 203/208, 212/223 | 224/227 | | | | | 43 | |
| 110 | | | | 480/492, 533 | | | | | | |
| 105 | | | 532 | 641/668 | | | | | | |
| 100 | 401/406 | | 493/496, 534/540<br>542/550, 585/602<br>609/613, 615/638 | 541/608<br>639/640 | 408/434<br>443/455<br>460/464 | | | | 122 | |
| 95 | | | 435/442, 457/458<br>465/479, 551/561<br>563, 565/579, 603/607 | 562/564 | | | | | 59 | |
| | | | | | | | | 72 | 5 | 1 |
| 90 | | | 456, 459 | | | 209/211 | | | 5 | |
| 85 | | | | | M. & A. 24 | | 521/524 | 73, 101/110, 152/155 | 18 | 15 |
| | | | | | | | 300/311, 395/400 | | | |
| 80 | | | | | | | 170/172, 174, 360, 371/373, 379/391, 393/394 | 117/119 (4 Wheel). | 23 | 3 |
| 70 | | | | | | | | | | |
| 65 | | | | | | | 1/6, 20/44, 66, 74/87, 90, 93, 95, 97/99, 120/121, 123/142, 173, 175/176, 229, 234/237, 239, 271/282, 285/297, 299, 351/353, 355/358, 361/365, 368, 374/378, 392, 525/527, M. & A. 27/30 | | 5 | |
| 60 | | | | | | | 45/53, 62/64, 67/71, 88/89, 91/92, 94, 96, 143/145, 147/148, 177/179, 184, 230/233, 238, 255/257, 260, 262/267, 269/270, 298, 359, 366/367, 369/370, 508/510, 515/517, 528, 530 | | 63 | |
| 55 | | | | | | | 186/188, 191/193, 240/241, 244/249, 345, 350, 511/513, 520 | | 20 | |
| 50 | | | | | | | 17, 100, 157, 159, 507, 514, 518, M. & A. 11, 13/15, 17, 18, 25, 26 | | 15 | |
| | | | | | | | Total Locomotives, 723. | | 674 | 49 |

not fair, as will be readily understood from the beef & grain train illustration. For the same reason, this uniform percentage of tare should be used in testing the resistance of different grades. Schedules of loads for engines should therefore be based on trains having a uniform percentage of tare. This is what we have done. We adopted the 2 to 1 basis, because we have a large number of cars which weigh about 15 tons, & have a capacity of 30 tons, or 2 to 1. We have very few larger capacity cars of our own. Therefore, we cannot look for many, if indeed any, trains that would have a lower percentage of tare than one-third. The conditions on some other railways may be such that they should adopt, for instance, a 3 to 1 basis. If so, they can make up their schedule of loads & compile their charts on that basis.

The second proposition is, that having determined the haulage capacity of engines with trains having this uniform percentage of tare, that then there should be some method of determining the comparative resistance of every train, & that engines should be loaded accordingly. This is accomplished by the chart, which is compiled on the basis that 30% more power is required to move the same tonnage in empties than in loaded cars, loaded 2 to 1. This 30% is a point which I anticipated I would hear about, & in reference to it I have to say that this method of rating & loading engines is in use as yet only on our Eastern

TABLE 3. INDEX TO HAULAGE CAPACITY AND DESCRIPTION OF LOCOMOTIVES.

| NUMBER. | %CAPACITY. | CLASS. | NUMBER. | %CAPACITY. | CLASS. | NUMBER. | %CAPACITY. | CLASS. | NUMBER. | %CAPACITY. | CLASS. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M&A 11 | 50% | 8 W,S | 159 | 50% | 8 W,S | 321/335 | 115% | 6 W,S | 508/510 | 60% | 8 W,S |
| " 13/15 | 50 | " | 170/172 | 70 | " | 336/341 | 120 | " | 511/513 | 55 | " |
| " 17/48 | 50 | " | 173 | 65 | " | 342/344 | 140 | " | 514 | 60 | " |
| " 24 | 85 | Mogul,S | 174 | 70 | " | 345 | 55 | 8 W,S | 515/517 | 60 | " |
| " 25/26 | 50 | 8 W,S | 175/176 | 65 | " | 350 | 55 | " | 518 | 50 | " |
| " 27/30 | 65 | " | 177/179 | 60 | " | 351/353 | 65 | " | 520 | 55 | " |
| 1/6 | 65 | " | 184 | 60 | " | 355/358 | 65 | " | 521/524 | 85 | " |
| 17 | 50 | " | 186/188 | 55 | " | 359 | 60 | " | 525/527 | 65 | " |
| 20/44 | 65 | " | 191/193 | 55 | " | 360 | 70 | " | 528 | 60 | " |
| 45/53 | 60 | " | 194/199 | 120 | 10 W,C | 361/365 | 65 | " | 530 | 60 | " |
| 62/64 | 60 | " | 200/02 | 120 | 10 W,S | 366/367 | 60 | " | 532 | 105 | 10 W,S |
| 66 | 65 | " | 203/208 | 110 | " | 368 | 65 | " | 533 | 105 | 10 W,C |
| 67/71 | 60 | " | 209/211 | 90 | ATL,C | 369/370 | 60 | " | 534/540 | 100 | 10 W,S |
| 72 | 90 | 6 W,S | 212/223 | 110 | 10 W,S | 371/373 | 70 | " | 541 | 100 | 10 W,C |
| 73 | 80 | " | 224/227 | 110 | 10 W,C | 374/378 | 65 | " | 542/550 | 100 | 10 W,S |
| 74/87 | 65 | 8 W,S | 229 | 65 | 8 W,S | 379/391 | 70 | " | 551/561 | 95 | " |
| 88/89 | 60 | " | 230/233 | 60 | " | 392 | 65 | " | 562 | 95 | 10 W,C |
| 90 | 65 | " | 234/237 | 65 | " | 393/394 | 70 | " | 563 | 95 | 10 W,S |
| 91/92 | 60 | " | 238 | 60 | " | 395/400 | 80 | " | 564 | 95 | 10 W,C |
| 93 | 65 | " | 239 | 65 | " | 401/406 | 100 | Con,S | 565/579 | 95 | 10 W,S |
| 94 | 60 | " | 240/241 | 55 | " | 408/434 | 100 | Mogul,S | 580/581 | 120 | 6 W,S |
| 95 | 65 | " | 244/249 | 55 | " | 435/442 | 95 | 10 W,S | 585/602 | 100 | 10 W,S |
| 96 | 60 | " | 255/257 | 60 | " | 443/455 | 100 | Mogul,S | 603/607 | 95 | " |
| 97/99 | 65 | " | 260 | 60 | " | 456 | 90 | 10 W,S | 608 | 100 | 10 W,C |
| 100 | 50 | " | 262/267 | 60 | " | 457/458 | 95 | " | 609/613 | 100 | 10 W,S |
| 101/110 | 80 | 6 W,S | 269/270 | 60 | " | 459 | 90 | " | 614 | 120 | 6 W,S |
| 117/119 | 70 | 4 W,S | 271/282 | 65 | " | 460/464 | 100 | Mogul,S | 615/638 | 100 | 10 W,S |
| 120/121 | 65 | 8 W,S | 285/297 | 65 | " | 465/479 | 95 | 10 W,S | 639/640 | 100 | 10 W,C |
| 123/142 | 65 | " | 298 | 60 | " | 480/492 | 105 | 10 W,C | 644/668 | 105 | " |
| 143/145 | 60 | " | 299 | 65 | " | 493/496 | 100 | 10 W,S | 669/731 | 115 | Con,C |
| 147/148 | 60 | " | 300/311 | 80 | " | 497/498 | 115 | Con,S | 732/738 | 153 | Con,S |
| 152/155 | 80 | 6 W,S | 312/315 | 120 | Con,S | 499/501 | 115 | Con,C | 739/740 | 115 | " |
| 157 | 50 | 8 W,S | 316/320 | 140 | " | 507 | 50 | 8 W,S | 741/786 | 115 | Con,C |

NOTE.—
8 W —Four driving wheels, coupled with four-wheel truck.
4 W — " " " " switcher.
6 W —Six " " " "
MOGUL— " " " " with two-wheel truck.
10 W — " " " " " four " "

ATL.—Four driving wheels, coupled with four-wheel truck and one pair idlers under firebox.
CON—Eight driving wheels, coupled with two-wheel truck.
S —Single expansion or "simple."
C —Double expansion or "compound."

TABLE 4.—RATINGS AND RULES FOR LOADING LOCOMOTIVES IN FREIGHT SERVICE.

| Conditions | Ordinary | | Bad Rail or Temperature 10° Above to 20 Below Zero | | Temperature Colder Than 20 Below Zero | |
|---|---|---|---|---|---|---|
| Class of Rating | Ordinary Freight Trains A | Fast Freight Trains B | Ordinary Freight Trains C | Fast Freight Trains D | Ordinary Freight Trains F | Fast Freight Trains G |
| Reductions From Schedule Loads | % Nil | % 10 | % 7 | % 12 | 12 | 15 |

Such regular trains as may be so designated by Superintendents, and any train with ten or more cars of live stock, provisions and perishables will be rated as "FAST FREIGHT TRAINS."
Superintendents may, in special cases other than those provided for herein, authorize a special rating.
The loads for engines during snow and wind storms will be determined at time according to conditions.
In making deductions for "Temperature" or "Bad Rail" the probable conditions over ruling grade and not at starting point, must be considered.
Where tare is not stencilled on cars the following estimated weights will be used:—

| | Tons. | | Tons. | | Tons. |
|---|---|---|---|---|---|
| 28 Feet Box | 10 | 35 Feet Coal 30 Tons | 15 | Coaches, Wide | 48 |
| 30 " Box or Stock | 11 | 35 " " 40 " | 17 | " Narrow Vestibule | 38 |
| 33 " " " | 13 | Empty Oil Tank | 15 | " Ordinary Platform | 28 |
| 34 " " " | 14 | Derrick and Tool, Etc | 20 | Colonist | 28 |
| 35 " " " | 16 | Flangers | 15 | Tourist | 30 |
| 33 " Palace Horse | 14 | Large Snow Plow | 50 | " Wide Vestibule | 37 |
| 50 " " " | 19 | Small " " | 25 | Mail and Smoking | 25 |
| 35 " Refrigerators, Pass | 20 | Caboose | 14 | Baggage and Smoking | 25 |
| 35 " " Fr't | 18 | Official, Long | 54 | Box Baggage | 17 |
| 33 " Ventilator | 13 | " Short | 36 | Baggage Long | 30 |
| 40 " Furniture | 15 | Sleepers, Wide Vestibule | 50 | " Short | 22 |
| 45 " " | 19 | " Narrow " | 43 | Baggage and Express, Long | 30 |
| 28 " Flats | 8 | " Ordinary Platform | 40 | " " Short | 22 |
| 30 " " | 9 | Parlor, Wide Vestibule | 54 | Mail and Express, Long | 30 |
| 33 " " | 10 | " Narrow " | 42½ | " " Short | 22 |
| 35 " " | 12 | " Ordinary Platform | 40 | Baggage, Mail and Express, Long | 30 |
| 33 " Coal | 10 | Dining | 45 | " " " Short | 22 |

1,000 to 2,000 pounds inclusive shall count as one ton, less than 1,000 pounds shall not count.
A Flanger working is to be rated at 100 tons.
The loads for locomotives may be exceeded up to 15 tons, if by doing so another loaded car may be taken.
The schedules of loads are for use with prescribed chart for calculating loads for locomotives according to proportion of tare to gross weight behind the tender and are based on trains of which the tare weight, including van, is 33⅓ of such gross weight.
NOTE—Figures in italics in hauling capacity schedules are based on the trains passing the stations without stopping.

lines, on which the controlling grades, except in a few instances, are about 1%, & as we desired to avoid complicating the new method at the outset, by having more than one chart, we have as yet only put in use a chart compiled on this 30% basis. I am well aware that the percentage of additional power required to move the same tonnage in empty as in loaded cars, loaded 2 to 1, decreases as the grade increases. The rolling friction does not increase, while the resistance due to gravity does, &, therefore, the percentage of additional power required is not constant. We have in mind, & I may say in hand, several charts for use on the different sections according to the ruling grades thereon. I think that when we put these in use, we will have overcome the only difficulties that we have encountered in connection with this system. We have found that 30% is too much on grades heavier than 1%, & not enough on easier grades.

Mr. Daly has raised a point as to speed of freight trains on grades. The 7 miles per hour is the speed over summits, & I freely admit that where trains are thick more tonnage can be moved with lighter loads & faster speed than by loading engines to the limit, with resulting long occupation of track, especially on grades. Such conditions are local, & have to be dealt with as you find them. This point, moreover, does not affect the two propositions I have advanced.

As to testing engines, we determined the relative haulage capacity of the different classes of engines, as far as we could, on one grade, using a dynamometer car, not by one, but by a great many tests of each class—not with engines that were all in good condition, with good firemen & good coal, but with engines & men as they came along, & then we took what we thought was a fair average. Having determined the relative haulage capacity of the different classes of locomotives on this one grade we then, by testing one or more classes of engines on the other portion of the line—also with the dynamometer car—were able to fix the haulage capacity of all classes of engines over all parts of the line.

Mr. Chairman, with your kind permission, I will resume my seat, & later on, if I have the privilege, I will say something in explanation of the second portion of the paper respecting the supervision of the loading of engines.

F. POTTER—I would like to ask in what office the comparative figures are kept & what increase of office force is necessary; also what is the increased train load above the old method brought about by the new method?

The CHAIRMAN—Prof. Hibbard, can you favor us with any remarks on this question?

PROF. H. W. HIBBARD—I would like simply to call attention to a paper read before the Northwest Railway Club in Dec., 1895, by H. H. Vaughan, on the hauling capacity of locomotives, the paper being discussed at the Feb. meeting, 1896; I have just been reading over that paper & discussion. Possibly some of the members may have the numbers in their files & would be glad to refer to them.

I notice in the discussion some remarks of J. N. Barr, that I thought were in point. He said: In the midst of all this discussion, about how we could increase our trains hauled & how the motive power department had increased the number & hard-working of its locomotives, all the brunt of increased train loads & cheapening of freight transportation seemed to have fallen upon the motive power department; but if the civil engineering department would do a little something to help out, that little something that they might do would be a very important assistance. He said further: "You talk about hauling your trains up these grades. Why not take out some of those grades? Why not fix up some of those curves, & so on?" It seems to me we need more of co-operation between the civil department & the mechanical department & the department that loads 60,000 lbs. capacity cars with only 20,000 or 30,000 lbs. If all the departments would co-operate we would accomplish more than by simply ourselves bearing all the brunt.

G. L. FOWLER—I was speaking the other day with the general manager of a road that probably hauls the largest average net tonnage of any road in the world, & he said that in his original report to his board of directors, when the matter of reducing grades & easing off curves came up, it would be cheaper to put & maintain pushing engines on those grades to help up the hills than it would be to pay the interest on the increased investment required to ease the grades & the curves. And at the risk of repeating perhaps something that you are all familiar with, I will state in regard to this same road, which is the Bessemer Line, from North Bessemer to Conneaut, I had the pleasure recently of going over it very carefully, & noting their tonnage rating & method of operation. They have moguls & consolidation engines hauling their trains, & they have a system of tonnage ratings there by which they take a car in units, as they call it. A unit, on their schedule, is 13,000 lbs., which is the weight of the lightest flat car which they have on the line. Of course their traffic is almost entirely conducted in steel cars of 100,000 lbs. capacity. They have a rating for their consolidation & mogul locomotives of 430 & 400 units each. That is, about 40 cars of about 100,000 lbs. capacity. But in their line from Albion to North Bessemer they have six hills, according to my recollection, & on each one of these they put pushing engines. On one of them they put two. Their schedule time for a freight train over the division, which is about 150 miles, is about 12 hours, & they maintain that speed clear through. The work that they do with pushing engines covers 27% of the total mileage of the road, & even on their climb up from Conneaut Harbor, where they have those largest engines in the world, with 24 by 32 in. cylinders, they put 40 cars on behind them & then give the engine a 10-wheel pusher to help up the first hill. But that train goes through practically without any break from Conneaut Harbor to North Bessemer, & their estimate is that they use only about half as many engines to carry the traffic through, using the pushers on the hills, that they would if they left each engine to a tonnage basis which they could carry over the controlling grades & let them go through with the trains without any assistance whatever. That this is a sensible method of operation is evidenced from the fact that, according to their own statement, they have the largest average net paying tonnage of any railway which reports to the Interstate Commerce Commission, & that practically means of any in the world. Their average net paying tonnage is between 900 & 1,000 tons. One month, I remember, it was 949 tons. That includes everything that goes over their lines behind a freight engine. If an engine goes over the road with a caboose car behind it, that is a train with no net tonnage, &, of course, that cuts down the average rate. Their expense of operation is phenomenally low, so low that most railway managers look at them with a good deal of envy. Possibly some of you may be as familiar with this line as I am.

J. S. EATON—May I ask Mr. Fowler a question? He speaks of their having the largest net tonnage. Does he mean per train? If so, does his second engine count for a second train? Does he include the return mileage light of road engines & helpers in computing his train mileage?

G. L. FOWLER—I do not think it includes the return mileage of the helper, but it includes light trains. As I said, if the engine goes over the road with nothing behind it but a caboose, that is a train with no net tonnage, so that if it is averaged up with a train that has 2,000 tons net behind the engine, the average net tonnage would be 1,000, & that

TABLE 5.—CANADIAN PACIFIC RAILWAY.

DAILY REPORT OF HAULAGE CAPACITY OF LOCOMOTIVES AND TONNAGE OF FREIGHT TRAINS OVER RULING GRADES ON HAVELOCK SECTION, NOVEMBER 1ST, 1900. DIRECTION OF BALANCE OF TONNAGE EAST.

| Train. | From | To | Locomotive. No. | Locomotive. Schedule Haulage Capacity, Tons. | Locomotive. Class of Rating | Locomotive. Net Schedule Haulage Capacity, Tons. | Tonnage over Ruling Grade. Contents. | Tonnage over Ruling Grade. Tare. | Tonnage over Ruling Grade. Total Actual. | Tonnage over Ruling Grade. Equivalent Tonnage. | Coal Used. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Extra | Havelock | Smith's Falls | 707 | 1,008 | "A" | 1,008 | 532 | 416 | 948 | 998 | 6 | |
| 54 | " | " | 739 | 1,008 | "A" | 1,008 | 400 | 513 | 913 | 1,003 | 6 | Live stock and Toronto shed freight |
| 56 | " | " | 725 | 1,008 | "B" | 908 | 382 | 464 | 846 | 922 | 5 | |
| 50 | " | " | 723 | 1,008 | "A" | 1,008 | 427 | 487 | 914 | 1,004 | 5 | |
| Way freight extra | " | " | 705 | 1,008 | "A" | 1,008 | 480 | 473 | 953 | 1,020 | 6.5 | Dressed beef and provisions. |
| 52 | " | " | 709 | 1,008 | "B" | 908 | 297 | 513 | 810 | 918 | 5 | |
| Extra | " | " | 743 | 1,008 | "A" | 1,008 | 537 | 423 | 960 | 1,007 | 6.5 | |
| | | | | 7,056 | | 6,856 | 3,055 | 3,289 | 6,344 | 6,872 | 40 | |

Percentage of Total Equivalent Tonnage taken to Net Schedule Haulage Capacity over Ruling Grades, 100%.

NOTE.—Under the old "actual tonnage" method of loading engines, these engines would each have been scheduled at "A" rating to take 913 actual tons through over the section, or a total for the seven engines (2 at "B" rating), of 6,209 tons—whereas under the new method they brought 6,344 tons through over the section—a gain of 135 tons, or 19.3 tons per train.

If the proportion of tare had been one-third on each train, this power would have taken 6,856 tons through over the section—or 512 tons more than it was able—owing to large proportion of tare—to bring through.