THE DIESEL-ELECTRIC LOCOMOTIVE AND THE RAILWAY EMPLOYEES

Robert James Agnew
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Signature of Author ________________
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Certified by ________________
Thesis Supervisor

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Chairman, Departmental Committee on Graduate Studies

387 Beacon Street
Boston, Massachusetts
June 12, 1952

Professor Earl B. Millard
Secretary of the Faculty
Massachusetts Institute of
Technology
Cambridge, Massachusetts

Dear Sir:

In accordance with the requirements for graduation, I herewith submit a thesis entitled, "The Diesel-Electric Locomotive and the Railway Employees."

Sincerely,

Robert J. Agnew

THE DIESEL-ELECTRIC LOCOMOTIVE AND THE RAILWAY EMPLOYEES

Robert James Agnew

Submitted to the Department of Economics and Social Science on June 12, 1952, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Since its introduction into switching service in 1924, to passenger service in 1934, and to freight service in 1941, the diesel-electric locomotive has become the dominant form of power on the railroads of the United States in each of these services. The superiority of the diesel over the reciprocating steam locomotive in economy and efficiency of operation, through its lower fuel and maintenance costs, its higher availability, its ability to accelerate rapidly, to draw heavier loads, to travel longer distances without requiring servicing or refueling, have all recommended its adoption to the carriers.

However, the same factors which led to the adoption of the diesel-electric led also to its being feared as a potential cause of labor displacement by the railway employees and their labor organizations. The historic trend in the industry toward the employment of fewer men per unit of transportation service furnished caused the railroad workers to view the innovation with suspicion and alarm.

The content of the jobs of many of the crafts employed by the carriers has been reduced or drastically altered. This is particularly true for the firemen, the engineers, the electricians and the machinists. The employment opportunities for some of the crafts have been reduced because their skills and services are not required on the diesel locomotive. The boilermakers have been affected greatly in this way with the blacksmiths and machinists suffering also, although to a lesser degree. The employment opportunities for electrical workers has increased because of the greater quantity of electrical equipment on the diesel-electric.

Both the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen have sought to require the employment of an additional member of their craft in the engine rooms of multiple unit diesels. Each of the organizations has twice carried its demands before an Emergency Board, in 1943 and in 1949. Each time the Boards have rejected the union demands. The normal crew of a diesel consists of an engineer and a fireman, the latter with inspection and patrol duties in the engine room.

Despite the fears of the two Brotherhoods that the new motive power would lead to the employment of fewer firemen and engineers, no noteworthy displacement can be detected in the employment statistics. In part, this has been the result of a unique system of payment whereunder train and engine service employees are paid either by time or by mileage, whichever results in the higher payment.

It is altogether possible that complete dieselization may result in some degree of labor displacement in the future. To date, however, such displacement is largely limited to certain of the shop crafts. The advantages offered by the diesel to the railway industry, and through it to the economy as a whole, can not but help to benefit the country and the economy in the long run. The price for this benefit in terms of technological displacement of workers promises to be so low that the country cannot afford not to pay it.

Thesis Supervisor: Douglass V. Brown.

Title: Alfred P. Sloan Professor of Industrial Management.

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I. INTRODUCTION

A. The Problem.

The diesel-electric locomotive represents one of the most significant developments in the transportation industry since the development of the airplane. It has effected a profound change in the railroad operating methods, maintenance methods, and managerial methods. It has displaced the steam locomotive entirely on many carriers, is in the process of replacing the older form of motive power on others, and has left untouched not a single major carrier in the country. Even the few which have not purchased diesels have had to adjust their steam operating methods to meet the challenge of the new power.

Just as the diesel has posed problems and wrought changes for railway management, so has it presented the railroad workers with a new set of problems. The "diesel problem" has loomed large on the scene of American railway labor in recent years and has been a matter of concern to the labor organizations dealing with the railroads. The skills of many workers have no place in diesel operation and maintenance. Craft patterns which evolved to cope with and work on the steam locomotive have, in many instances, lost their significance. Jurisdictional arrangements among the various labor groups and between workers and employers have become blurred and confused with the changing nature of the work to be done.

Railway labor has reacted to the innovation in a manner familiar to any student of labor. Firemen and engineers have feared displacement through dieselization and have attempted to secure the employment of additional members of their crafts as the price for acceptance of the innovation. Certain of the shop crafts, seeing their skills and customary duties atrophy as dieselization spread, have attempted to expand their jurisdictional lines to encompass the new work offered by the diesel.

Carriers, in the effort to obtain the maximum advantage from the economies of the new power, have resisted the attempts of the labor organizations to impose additional labor costs on the diesel.[1] The "diesel problem" has resulted in controversy between carriers and workers. This controversy has affected the public interest through the medium of strikes and threats of strikes in the industry. On three occasions an Emergency Labor Board has been appointed by the President of the United States to enquire into the facts of the segment of the problem as seen by the firemen and engineers. The other crafts have not gone to these extremes, but have engaged in various movements aimed at a solution of the problem acceptable to them. Despite all of these efforts, the "diesel problem" is by no means a settled one. It and its ramifications will continue to be of great importance on the labor relations scene in the railway industry.

It is the purpose of this inquiry to examine the nature of the diesel-electric locomotive in terms of the characteristics which have led to its adoption by the carriers, in terms of its effects upon various sectors of railway labor, and in terms of the attempts at solution of the "diesel problem." Since it is the threat of a form of technological displacement to which most of the labor organizations have reacted, an attempt must be made to appraise the effects of the

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[1] David P. Morgan, "How Many Diesels, How Soon?" in: Trains and Travel, Vol. 12, No. 6, April, 1952, p. 52.

diesel upon the employment of the various crafts concerned. This can properly be done only in the light of history and the past relationships between employment in the industry and the various factors which have acted upon it. Only in so far as the diesel either creates or intensifies already existing problems, only to the extent that it alters already existing patterns, can it properly be blamed for displacement.

B. Characteristics of the Diesel-Electric Locomotive.

1. What it is and how it works.

The diesel-electric locomotive essentially consists of an internal combustion diesel engine driving an electric generator which supplies current to electric motors connected to the driving wheels of the locomotive. The propelling mechanism of this type motive power is electrical.

Electric traction accounts for most of the operating characteristics which render this type power superior in many respects to the reciprocating steam locomotive. Although these characteristics are inherent in electric traction, the huge capital investment necessary for power stations, transmission lines, etc. has prevented a more general use of electric locomotives. The increasing use of the diesel has resulted, in part, from its ability to develop its own electric power without the extensive fixed plant formerly required for electric traction, while retaining the mobility of steam power.

The power developed in the motors connected to the wheels of the diesel depends upon the amount of current flowing through the motors. The close control possible in electric circuits over the current flow enables the engineman to regulate closely the amount of torque or rotary power reaching the driving wheels. Since the electrical current flows without interruption from the generator, this power flow is continuous.

The reciprocating steam locomotive obtains its power from the expansion of steam in a horizontal cylinder. The reciprocating motion is converted to rotary motion by means of a crank. The surge of power comes with each individual admission of steam into the cylinder, two for each revolution of the driving wheel. The power delivered to the wheel is intermittent rather than continuous.

The close control over power and the continuous flow of power make it possible for the diesel-electric to achieve adhesion between the driving wheels and the rail far greater than that permitted by the power characteristics of the steam locomotive. The wheels of a diesel are much less likely to slip at starting than is the case with the reciprocating power. It has been demonstrated that a coefficient of adhesion as high as thirty-three per cent is possible for the diesel compared to a maximum of twenty-five per cent for steam.[1] This means that one-third of the weight of the diesel locomotive is translatable into forward motion, compared with one-fourth for steam.[2]

These three factors make the diesel electric locomotive far superior to the steam variety in the ability to start heavy loads moving over the rail and to keep loads moving at low speeds. This characteristic is particularly important in switching service and

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1. L. K. Sillcox, Head-End Horsepower (Syracuse University, 1949), p. 11.

2. For a full development of the adhesion characteristics and comparative deficiencies of steam power, see: R. P. Johnson, The Steam Locomotive (New York: Simmons-Boardman, 1942, pp. 126 ff.

accounts in part for the rapid spread of diesel-electric power in that area.

Freight service also requires the starting of heavy loads and the exercise of great power at low speeds. This maximum tractive effort (the ability measured in pounds, to move a load) requires the passage of large amounts of current through the traction motors. While maximum current can be utilized for short periods of time, continuous large current flow damages the traction motors through overheating them. Therefore, in practice, while great tractive effort is secured for starting and for emergency short-time conditions without damage to the motors, the work the diesel will be called upon to do must be studied carefully. Coasting, stopping, or layovers must be arranged so that the total amount of current passing through the motors in any one hour will not be excessive.

In contrast, the steam locomotive can exercise its full power over unlimited time, but its full power is not realized at low speeds. Fundamentally, the steam locomotive has a rising power characteristic as speed increases. This is because the number of engine power strokes varies directly with the speed-- limited in the higher speed ranges by the capacity of the boiler to deliver steam to the cylinders. The diesel, however, has an almost constant horsepower output which results in a decreasing tractive force as speed increases. To obtain equal drawbar pull at higher speeds, a higher horsepower rating is necessary for a diesel-electric locomotive than for steam. However, any disadvantage suffered at high speeds by the diesel-electric can be overcome in part by suitable gear ratios designed for the assigned service. This does result in slightly less flexibility on the part of the individual diesel-electric unit as compared to the steam locomotive, but the flexibility gained through the ability to operate in multiple units more than compensates. This objection has been held to be minor when compared with the advantages of diesel-electric power.

2. Advantages of the diesel-electric locomotive.

Despite any operating advantages the new form of motive power might have held, it had to prove itself to the carriers on the basis of cost. The superiority of the diesel in this area arises from its thermal efficiency advantages, and its maintenance requirements.

The comparatively high thermal efficiency of the diesel-electric locomotive in comparison with steam motive power is responsible for much of its relative economy. The energy potentialin a given quantity of fuel is realized to a much greater extent in the diesel-electric locomotive than in any form of existing competing motive power.

The use of superheated steam with single expansion characterizes the average steam locomotive in use today. As is shown in Table I, this delivers approximately seven per cent thermal efficiency, as compared with about thirty per cent for the diesel-electric locomotive. The last great challenge to the diesel-electric locomotive by the designers of reciprocating steam motive power was in high pressure steam. Even in this, however, the thermal efficiency managed to reach only about ten per cent.

TABLE I

THERMAL EFFICIENCY AT WHEEL
VARIOUS TYPES OF RAILWAY MOTIVE POWER*

Type of Motive Power	Per Cent Efficiency at Wheel
Saturated steam, single expansion	5.0
Superheated steam, single expansion	7.0
Superheated steam, compound expansion	8.0
Condensing Steam Turbine, Electric Transmission	8.5
High Pressure Steam, single expansion	10.0
High Pressure Steam, Condensing	12.0
Gas Turbine, Electric Transmission	16.0
Diesel-electric	30.0

* SOURCE: G. H. Allen, The Railway Locomotive (New York; Harcourt Brace and Company, 1941), p.176.

The comparatively high thermal efficiency of the diesel-electric enables it to recover and develop as useful work about thirty per cent of the total heat in the fuel. This results in substantial savings in fuel costs compared to other forms of motive power.

TABLE II

RELATIVE FUEL COSTS FOR VARIOUS SERVICES,
CLASS I STEAM RAILWAYS IN THE UNITED STATES,
MARCH, 1949*

Unit and Service	Coal Steam	Oil Steam	Diesel-Electric
Per Locomotive Switching Hour	$2.41	$3.05	$0.69
Per 1,000 Gross Ton-Miles, Freight	0.352	0.399	0.165
Per 1,000 Passenger Miles	0.052	0.051	0.029

*SOURCE: "Fuel and Power Statistics of Class I Steam Railways", Bureau of Transport Economics and Statistics, Interstate Commerce Commission. Statement M-230, March, 1949.

A study made by the Bureau of Transport Economics and Statistics of the Interstate Commerce Commission revealed that in the first six months of 1950, the Class I railroads of the country were able to carry 2.3 times as many gross ton-miles of freight per dollar spent on diesel fuel than per dollar spent on coal, 2.2 times per dollar spent on fuel for oil burning steam engines, and over twice as many per dollar than for purchased electric current for electric locomotives.[1] Diesel fuel has not increased in price per unit relative to coal. From 1939 to 1949 the average cost per ton of coal increased 105 per cent. During the same period the price of diesel fuel rose 103 per cent.[2]

Fuel costs have been one of the more important savings of the diesel-electric locomotive, but the economies do not end with fuel. The cost of water for a steam locomotive is a considerable item of expense. The steam locomotive may evaporate more than 70,000 pounds of water per hour. With the exception of rain water, melted snow, and condensate, all water supplies are contaiminated with mineral salts, vegetable matter, or acids. If these impurities are not removed, they will corrode the boiler or deposit scale on the inside of the boiler tubes. This scale acts as a heat insulating material and may cause heat losses up to 12 per cent.[3] The railroads are forced

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1 "Monthly Comment on Transportation Statistics," Bureau of Transport Economics and Statistics, Interstate Commerce Commission, September 14, 1950, p.7.

2 <u>Sixty-third Annual Report on the Statistics of Railways in the United States</u> (1949), Interstate Commerce Commission (Washington: Government Printing Office, 1951), Table 71, p.68. (Hereinafter cited as: <u>Annual Report on the Statistics of Railways</u>.)

3 R. P. Johnson, <u>op</u>. <u>cit</u>., p.109.

to spend large sums for treatment of the water required by the boilers of the steam locomotive.

The New York Central operates for the most part through territory where water is abundant, yet it has calculated that for its most modern steam locomotives the water cost approximates three cents per mile. This compares with a per mile cost of approximately one-half of one cent for diesel power on the same assignments.[1] Water costs for steam switching power on the Burlington Lines were calculated at eleven cents per switching hour; the cost for diesel-electric operation was an insignificant fraction of one cent.[2]

The savings in water costs are possible because the water requirements of the diesel are negligible in comparison with steam. Water is used in the radiators of the diesel engines for cooling and, in passenger service, for heating the train with steam. It is seldom necessary to add water to the diesel en route as these locomotives can carry several days' supply. This eliminates many of the service stops which are necessary for the steam locomotive. The diesel thus can attain a higher average speed over a given distance or maintain the same average as the steam locomotive although operating at a lower maximum speed.

High utilization is another of the outstanding advantages of the diesel-electric locomotive. This strongly recommends the adoption of this type of motive power to railroad operating officials. Utilization may be measured on a relative, or on an

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[1] P. W. Kiefer, A Practical Evaluation of Railroad Motive Power (New York: Steam Locomotive Research Institute, 1947), p. 48.

[2] F. G. Gurley, "Diesel Engines in Railway Service," Railway Age, Vol. 100, May 9, 1936, p. 763.

absolute, basis. In both passenger and freight service, the mileage per locomotive per year indicates directly the absolute utilization. The time the locomotive is in use divided by the time the locomotive could have been used yields a percentage figure valuable as a yardstick of relative utilization. By either of these measure, the diesel-electric has demonstrated a superiority over the older form of motive power.

In passenger service the diesel has been able to operate as many as 250,000 miles per locomotive per year, and up to 27,000 miles per month. This is in contrast with 180,000 miles per year and a monthly mileage of 18,000 to 19,000 miles for steam passenger locomotives.[1]

The New York Central experimented with diesel power in 1946 and operated both steam and diesel under identical conditions, so far as was possible. The results of this study indicated that steam could produce a potential of 26,226 miles per month; the diesel-electric, 27,496. In terms of average miles per day, the respective figures were 862 and 904 miles. In this test only the most modern steam power was used and the diesels were given no preference in assignments.[2]

In still another instance, the diesel-electric assigned to the "Capital Limited" of the Baltimore and Ohio Railroad had 100 per cent availability over a period of twelve months. This locomotive made a 772 miles run between Chicago and Washington for 365 consecutive days. The locomotive arrived in the morning and departed

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[1] E. E. Chapman, "Steam vs. Diesel-Electric Power". Railway Age, Vol. 111, July 26, 1941, p. 173.

[2] For details of this interesting study see: Kiefer, op. cit., passim.

in the same afternoon at each terminal and the longest period during the entire year in which the locomotive was available for servicing was six and one-half hours.[1]

Because of this greater availability and higher utilization, it has been possible for a fleet of diesel-electric locomotives to replace a much larger number of steam locomotives. The Maybrook line of the New Haven replaced 46 steam locomotives with 15 diesel-electrics and improved schedules and train loads in the process.[2] However, diesels cannot escape the law of diminishing returns. The New York Central dieselized approximately 46 per cent of its locomotive mileage by early 1952 with 1235 diesel units. At this rate of utilization in theory the system could replace all of its steam engines with a total diesel fleet of approximately 2,500 units. Officials of the road hope to convert completely to diesel operation by 1950 but expect to use at least 4,600 units for full diesel operation.[3] Such variations from theoretical requirements based on past records arise from the fact that most of the carriers have assigned the more expensive diesel locomotives first to long distance runs which permit greater utilization. In the event of complete dieselization, standby power must be kept in order to provide for peak traffic loads. Optimum utilization of units assigned to more sporadic services cannot be achieved. Despite this less than theoretical performance, diesels will be able to replace steam in a ratio of two to three, or three to four.

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1 "B.& O.Diesels on the Job 365 Days in a Year", Railway Age, Vol. 108, March 9, 1940, p. 469.

2 "New Haven Changes Maybrook Freight Line to Diesel-Electric", Railway Age, Vol. 124, June 19, 1948, p. 1197.

3 D. P. Morgan, op. cit., p. 53.

The higher initial cost of diesel-electric power relative to steam and the greater contribution to fixed charges represented by this higher initial cost are not important in the long run. Both are more than over-balanced by the utilization advantages. The high degree of availability of the diesel locomotive permits the armortization of this type power over a shorter time period than is possible with less utilized locomotives. This is sufficient to overcome the disadvantage of higher first cost.

Mr. J. M. Symes, Vice-President in Charge of Operations of the Pennsylvania Railroad, one of the last of the major carriers to adopt diesel power, justified the abandonment of steam in terms of the marginal efficiency of capital in fixed and initial cost terms:

> Rights up to and through World War II we were leaning toward the further development of the steam locomotive and the extended use of electrification. The economy of the diesel had not sufficiently proven itself to us.
>
> During 1939 we could have acquired the most modern heavy duty steam locomotive at a cost of approximately $150,000. We could have extended our electrification west from Harrisburg to Altoona, including the required electric locomotives, for approximately 47 million dollars. A 6,000 horsepower diesel locomotive at that time cost something like $550,000 . The price of coal was but $2 a ton, and by reason of its abundant supply on our railroad the hauls to consuming point were not excessive.
>
> To place the higher initial cost of diesels against the lower initial cost of steam locomotives or the 47 million dollar electrification project on the Middle Division between Harrisburg and Altoona at that time would have shown but a doubtful 5 per cent or 6 per cent annual saving.

> What happened to change this? The cost of the $150,000 steam engine progressively increased to a $300,000 figure. The 47 million cost of the electrification between Harrisburg and Altoona progressively increased to a 105 million dollar figure. The cost of the $550,000 diesel progressively increased to a little over $600,000. The price of coal increased from $2.00 to $4.60 a ton. Wage rates increased 47.9 per cent from 1939 to 1946, and to 74.5 per cent as of today 1949 on the Pennsylvania Railroad. The doubtful 5 or 6 per cent return on the diesel against the other forms of motive power at the beginning of the War moved into a definite return of about 30 per cent at the end of the War, and inasmuch as a large motive power program was required on our railroad to take care of obsolescence and increase operating efficiency, that is when we moved into the diesel field. [1]

It is probable that the experience of the Pennsylvania has been the rule rather than the exception and this experience offered ample reason for the adoption of the diesel-electric in preference to competing forms of motive power.

There are other less obvious advantages inherent in the use of the diesel internal combustion enginer with electric traction. These include several effects upon the maintenance of track and structures. The absence of unbalanced rotating parts in the diesel locomotive removes the dynamic augment or rail pound which results from a necessary imbalance on reciprocating steam locomotive driving wheels. The unbalanced weights on steam drivers contribute to a centrifugal force which tends to lift the wheel off the rail during one phase of the rotation cycle and causes it to bear more heavily on the on the rail in the downward phase of rotation. This pounding, which contributes greatly to track and structure stresses, is absent in the diesel.

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1 Transcript of Proceedings of the Emergency Board in so-called "Engineers' Diesel Case", Brotherhood of Locomotive Engineers vs. Designated Railroads, 1949, Vol. 14, p.2360. (Hereinafter cited as: Transcript, Engineers' Diesel Case.)

The diesel does have a disadvantage in this connection which is not generally shared with the steam locomotive as high wheel loading in proportion to wheel diameter is characteristic of diesel locomotive design. It is altogether possible that the problem of high wheel loading may replace dynamic augment as an important factor in the determination of rail life. Wear and tear on track and structures by locomotives is directly reflected in maintenance costs.

The fouling of track ballast by the continuous rain of cinders and ashes from the fireboxes of coal-burning locomotives has been a problem in track maintenance. Fouling of ballast can lead to improper drainage of surface water which can result in increased rusting of rail tie-plates and rotting of ties. This potential source of increased maintenance is not a problem with the diesel locomotive.

A lower center of gravity than is possible with steam power is characteristic of diesel design and is a factor in track and structure wear. This is particularly true in high speed operation where the speed on curves is limited absolutely by the theoretical overturning speed of the locomotive. The lower center of gravity permits higher operating speeds in the same service and also contributes to less rail wear on curves.

It is not possible to draw any valid quantitative conclusions concerning the effects of dieselization on track maintenance costs because many of the variables are completely independent of the kind of motive power used. These variables include the increasing mechanization of track maintenance, the quantity of deferred maintenance, the weight and speed of the traffic borne by the rail, the design and the weight of the rail, etc. It may be said only that the absence of unbalanced rotating parts in the running gear of the locomotive will reduce stresses in track and structures and, hence, the amount of maintenance required, provided that wheel loadings do not reach the critical level.[1] The other diesel characteristics bearing on the track maintenance problem may exert some long-run effects toward reducing costs.

Diesel locomotives are not completely free from objectionable combustion gases, but they are vastly cleaner in operation than steam engines. The absence of coal smoke and fumes is an important consideration even in non-urban operations. Extensive blower installations have been found necessary in many tunnels to protect the crews of steam locomotives from the gases produced by the combustion of coal. As alternatives, electric locomotives have been used in some tunnel operations as have cab-in-front steam locomotives.

The products of coal combustion form acids which attack structural members in bridges, underpasses, and other structures. The inhibiting and correction of such corrosion is a considerable item of expense which is reduced greatly by the use of the diesel locomotive.

For the most part, diesels have been assigned to select and difficult runs. On these the new motive power has demonstrated outstanding economies and advantages. The advantages of diesel-electric operation are multiplied greatly when it is used to the exclusion of steam power, and the full economies are realized only after complete dieselization.

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[1] A non-technical development of this aspect of the diesel is found in: Chapman, op. cit., p.175-7.

The railroad must maintain complete facilities for repair, fueling, water supply, cinder-handling, etc., so long as any steam power is in use over a particular section. The concomitants of steam operation can be abandoned only when the diesel is the only motive power in use.

A dieselized railroad can use utility switching locomotives and combination freight-passenger units. This permits two types of power to replace as many as seven classes of steam locomotives. Three or four types of diesel power can meet all of the locomotive needs, even if combination units are not used.

A Committee of the American Association of Railroad Superintendents reported in 1949 on the "Benefits from Complete Dieselization of an Entire Division or Subdivision". This report cited a district with 950 miles of track in which 165 steam locomotives were replaced by 100 diesel-electric units used in multiples of one, two, and three. The district was able to abandon its steam locomotive repair facilities, six boiler-washout plants, eight mechanical cinder hoists, 44 water stations, 40 water treating plants, and 17 coaling stations.[1]

On another railroad studied by this Committee, twelve diesels of only two types replaced twenty-six steam locomotives of five types. After dieselization, operating costs including fuel, water, lubrication, maintenance, wages of maintenance and train-service employees, maintenance of facilities, and depreciation were

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[1] "Superintendents Probe Wide Range of Problems at 53 Convention", Railway Age, Vol 126, June 25, 1949, p. 1248.

$969,996 a year. With steam power these costs had been $1,491,468. A net return of 15.3 per cent on the investment in diesels resulted from these savings.

The reduction in the number of locomotive types in use on any particular portion of road results in a sharp reduction in the spare parts inventory which must be carried. The maintenance forces need not be prepared to replace any one of a hundred different parts on six or seven different locomotive types.

The advantages of dieselization are cumulative and the implications for railway labor are the greatest where diesel-electric locomotives have replaced all of the steam motive power.

C. History and Scope of Dieselization

The diesel-electric locomotive is a comparative newcomer to the railroads of the United States. This form of motive power was first applied to switching service and was thought suitable only for this limited use for many years.

In the early 1920's, the American railroads, locomotive manufacturers, and diesel engine builders realized that the steam switching locomotive was very inefficient and objectionable. The smoke and noise of a steam locomotive constituted a problem, particularly in metropolitan areas.

The General Electric Company and the Ingersoll-Rand Company were the first to approach this problem constructively. Beginning with the Central Railroad of New Jersey in 1925, this combination supplied railroads in the New York City area with diesel-electric switching locomotives. This development, however, did not spread rapidly. At the end of 1934 only approximately 100 such locomotives were in use, but within the next five years over 300 came into service. Between January 1, 1940, and December 31, 1944, over 1,500 more were purchased. By the end of 1949, over 2,500 more had been added to the rosters of the carriers. An additional thousand new ones added in 1950 brought the total at the end of that year to 5,687.[1] Diesel switching power at the end of October, 1951, numbered 6,413, representing about 51 per cent of the total switching locomotives in service.[2]

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1 Annual Report on the Statistics of Railways, 1949, p.18.

2 "Motive Power and Car Equipment of Class I Steam Railways", Bureau of Transport Economics and Statistics, Interstate Commerce Commission. Statement M-240, October, 1951.

The spread of the diesel to passenger service did not occur until 1934. Early in 1933, the Chicago, Burlington and Quincy Rail Road Company determined to build a small, streamline train which later became known as the "Zephyr". A light-weight, internal combustion engine was essential for a train such as the officials had in mind. General Motors Corporation had developed a new, two-cycle diesel engine using strong, new metal alloys. Weight per horsepower was reduced from over 150 pounds to 21 pounds in the new engine.

Mr. Ralph Budd, then president of the Burlington Lines, saw two of the remarkable new engines on exhibit in the General Motors' Building at the Century of Progress in Chicago in the summer of 1933. He was able to visualize "one of them in the Burlington streamline train which was then being built". After experiencing difficulties in cooling the engine within the limited confines of a locomotive, the manufacturers pronounced the engine satisfactory for installation early in 1934. On April 7, 1934, the train came out, and two days later on its trial trip attained a speed of 104 miles an hour.[1]

The new train and its diesel-electric power were both very successful and the lead of the Burlington was followed by several other roads soon thereafter. Bankrupt roads were among the early adopters of diesel power. The absence of the necessity to pay bond interest permitted trustees to invest cash in the newer motive power, an action which speeded the recovery of many of the roads.[2]

By the end of 1939, ninety diesel-electric passenger units were in use. In the next five years about two-hundred were added. With

[1] Mr. Budd told the interesting story of the Burlington's experiment at a luncheon in New York City commemorating the fortieth anniversary of the diesel engine. Reported in: Railway Age, Vol. 103, Nov. '37, p.636

[2] "Progress Through Diesels", Investors' Reader, Vol. 12, May 11, '49, p4

the end of the war, the rate of adoption increased and 381 were purchased by the carriers in 1947. The trend has continued in recent years and at the end of October, 1951, 1433 diesel-electric passenger locomotives were in use--about thirty per cent of all passenger locomotives.[1]

The railroads have seen the popular appeal of higher speeds to a public made conscious of speed by the progress of air transport. The diesel is most strongly indentified with passenger service in the eyes of the public. It is the high-speed, "name-train," drawn by a colorful and streamline diesel which is regarded as the natural element of this type motive power. By lightening the equipment, streamlining the exterior surfaces, improving braking methods, etc., the carriers have put into operation trains with much faster schedules than was previously possible.

On a basis of high top speed alone, however, the steam locomotive is certainly the equal of the diesel. But, in any consideration of high-speed operation, the problem of sustained speeds must carefully be balanced against maximum speed considerations. The reduction of delays during stops, of time required to accelerate the train up to operating speed from a stop or a slow down, or of the time required to brake the train to a stop from a high speed, can contribute more to maintaining a high average speed over a route than can a simple increase in maximum speed.

The diesel characteristics permit high average speed without excessive maximum speed. A 3600 horsepower diesel-electric locomotive

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1 "Motive Power and Car Equipment", October, 1951.

can reach a speed of 87 miles per hour in slightly over 13 minutes; an equivalent steam locomotive with an identical train consumes over 17 minutes in accelerating to the same speed.[1]

A similar advantage is held by the diesel in braking. Less time is required for the diesel powered train to slow down or to stop. In both steam and diesel powered trains the locomotive weight is a large portion of the total train weight, but the diesel can be braked at a level higher than steam power and more consistent with the braking level of the trailing cars.[2]

Field tests made with diesel and steam powered trains have indicated that a ten-car, diesel-powered, light-weight train running at a speed of 110 miles per hour could be brought to a stop within 3,675 feet. At 90 miles per hour, within 2,550 feet. This is approximately forty per cent less distance than is required by a steam powered train.[3]

An added braking advantage possible with the diesel-electric is "dynamic braking". This involves using the traction motors as electric generators while the locomotive is decelerating. The energy thus produced is transformed into heat by electric resistance circuits and released to the atmosphere. This method of braking reduces greatly the air-brake applications necessary to slow or stop the train and also speeds and improves the braking process.

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[1] "Motive Power and Car Equipment", October, 1951.

[2] H.M.Jacklin, Testimony in: Transcript of Proceedings of the Emergency Board in so-called "Diesel Case", Brotherhood of Locomotive Engineers and Brotherhood of Locomotive Firemen and Enginemen vs. Designated Railroads, 1943, Vol. 12, p.230. (Hereinafter cited as: Transcript, Diesel Case.)

[3] L.K.Sillcox, Mastering Momentum (New York: Simmons-Boardman, 1941), pp.70-3. The braking characteristics of the steam locomotive are discussed at some length in this technical treatment.

The combination of these many advantages made the diesel particularly attractive for passenger train operation. For several years, however, railroad officials considered that high-speed passenger service marked the limit of the diesel's railway application.

It was not until 1941 that the first diesel-electric powered main-line freight train appeared. Previously, seven diesel locomotives had been assigned to freight service, but the application of diesel power to freight service in the manner it is used today began on the Santa Fe February 5, 1941, when a diesel left Argentine, Kansas, with a freight train for Los Angeles.[1]

On this pioneer freight run, no particular attempt was made for a speed record either by means of unusually high operating speeds or reduced delays on the road and at terminals. The running time for this trip of 1,761.8 miles was 54 hours, 35-1/2 minutes, an average running speed of 32.3 miles per hour. The maximum speed attained during the run was 68 miles per hour. The locomotive demonstrated ample reserve capacity to handle heavier trains than the one used in the test and at substantially higher speeds. The use of dynamic braking on the locomotive resulted in a reduction in the number of air brake applications to one-fourth the number ordinarily necessary. A total of seven steam locomotives would have been required for the entire trip and not less than 28 stops for water or fuel. The diesel made the run with only four stops for fuel.[2]

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[1] "Santa Fe Tests Main-Line Diesel Freight Power", Railway Age, Vol. 110, pp. 452-8.

[2] Ibid., p.456-7.

Operating officials regarded this trip as highly successful. The economies and advantages of diesel-electric power in freight service were conclusively demonstrated. During 1941, 47 freight units were placed in service on the railways and the last field had been won by the diesel.

The production limitations imposed by the War inhibited the adoption of this new power to a high degree, but 845 were placed in service by the end of 1944. The end of the War marked the start of a rapid trend toward diesel freight power and at the end of October, 1951, the 4730 diesel locomotives assigned to freight service accounted for 25 per cent of the freight locomotives in use.[1]

Only 14 of the Class I railroads of the country operating locomotives in 1950 did not use some diesel power and three of these placed orders for diesels in the course of 1951. Most of the non-diesel roads are small, relatively unimportant carriers. With the single exception of the Norfolk and Western Railway, none of these are over 1,000 miles in length. The Norfolk and Western, virtually the last major citadel of steam, began construction of six freight steam locomotives and fifteen steam switching locomotives in 1951. This was the only steam construction for an American carrier during the entire year.[2] The road is primarily a coal hauling railroad with abundant coal supplies on line.

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[1] "Motive Power and Car Equipment", October, 1951

[2] "Motive Power Orders in 1951", Railway Age, Vol. 132, January 14, 1952, p.204.

The increase in importance of the diesel at the expense of other forms of motive power is shown in the following table.

TABLE III

LOCOMOTIVES ORDERED, 1939-1951*

Year	Steam	Diesel	Electric	Total
1951	22	4,071	14	4,107
1950	15	4,473	28#	4,516
1949	13	1,782	10	1,805
1948	54	2,661	2	2,717
1947	79	2,149	1	2,229
1946	55	989	8	1,052
1945	148	691	6	845
1944	74	680	3	757
1943	413	635	0	1,048
1942	363	894	12	1,269
1941	302	1,104	38	1,444
1940	207	492	13	712
1939	119	249	32	400

1951, 1950, 1949 and 1948 diesel orders are calculated in units; previous years statistics were kept in locomotives, which may include one or more units.

Includes 10 gas turbine electrics.

*SOURCE: Railway Age, Vol. 132, January 14, 1952, p.202.

It should be noted that despite the rapid strides of dieselization, there were 22,343 steam locomotives left on the Class I railroads of the country as of November 1, 1951. The largest number of installations of diesel-electric locomotives, and a comparable number of steam retirements, came in the period 1947 to 1951. Even if the rate of replacement were to continue at the 1951 rate, many years would elapse before all of the steam power disappears. It is a matter of conjecture whether or not this ever will actually take place.

TABLE IV

COMPARATIVE OWNERSHIP OF MOTIVE POWER*

STEAM LOCOMOTIVES

Type	1941	1950	1951	1941-1951 Change	1950-1951 Change
Passenger	6,727	3,867	3,269	- 3,458	- 598
Freight	24,378	16,387	14,352	-10,026	-2,035
Passenger or Freight	1,245	1,095	1,030	- 215	- 65
Switching	7,110	4,225	3,697	- 3,413	- 528
	39,460	25,575	22,348	-17,112	-3,227

DIESEL-ELECTRIC LOCOMOTIVES

Type	1941	1950	1951	1941-1951 Change	1950-1951 Change
Passenger	168	996	1,049	881	83
Freight	34	2,503	3,585	3,551	1,082
Passenger or Freight	2	325	509	507	184
Switching	982	5,580	6,786	5,804	1,206
	1,186	9.374	11,292	10,743	2,555

*SOURCE: Railway Age, Vol. 132, January 14, 1952, p.203.

It would appear that the diesel-electric is the locomotive of the immediate future. Longer range developments in the area of coal or gas turbines show a high degree of promise, but these locomotives bear more similarity to the diesel than to reciprocating steam.

The coming to fruition of any motive power developments now on the horizon will not materially change the nature of the problems posed by the diesel-electric locomotive for the carriers and for the employees and their labor organizations.

II. TRENDS AND RELATIONSHIPS IN EMPLOYMENT

To appraise the effects of the diesel-electric locomotive upon railway employment it is necessary to examine past trends and relationships in the industry. In 1949 there were roughly only two hundred thousand more workers employed in railroading than there had been in 1900. This eighteen per cent increase in employment was accompanied by a mileage rise of only sixteen per cent traffic units (twice passenger miles plus freight ton miles) increased 167 per cent. It is obvious that many factors have been operating to increase the productivity of the railroad employee in terms of the goods and people he transports.

From Table V it can be seen that the peak of railway employment was reached in 1920 when over two millions were at work on the railroads of the country. That year was also a peak traffic year and volume reached a level higher than any other year up to 1926. It should be noted that the latter year, although two per cent higher in traffic than 1920, had a labor force twelve and one-half per cent smaller. In traffic units per worker terms, the 1920 worker accounted for 244,912 traffic units, while the 1926 worker had 284,791.

The traffic volume of 1926 remained a peak until 1941 when the demands of the war sent traffic upward, a rise which continued unbroken through 1944. Traffic units per worker also rose with the advent of the heavy war traffic, but reached a maximum of 658,896 in 1943, a year before the traffic peak.

TABLE V

RAILWAY EMPLOYMENT AND TRAFFIC*

Year	Workers	Traffic Units	Units per Worker	Year	Workers	Traffic Units	Units per Worker
	000	000					
1900	1,018	173,673	170,602	1925	1,786	489,752	274,217
1901	1,071	181,785	169,733	1926	1,822	518,790	284,791
1902	1,189	196,669	165,407	1927	1,776	499,610	281,311
1903	1,313	215,053	163,787	1928	1,692	499,523	295,226
1904	1,296	218,368	168,493	1929	1,694	512,519	302,549
1905	1,382	234,063	169,365	1930	1,517	439,567	289,767
1906	1,521	266,212	175,024	1931	1,283	354,939	276,647
1907	1,672	292,039	174,664	1932	1,052	259,303	255,991
1908	1,436	276,498	192,582	1933	991	283,387	285,960
1909	1,503	277,021	184,312	1934	1,027	306,430	298,373
1910	1,699	319,693	188,165	1935	1,014	320,657	316,229
1911	1,670	320,188	191,729	1936	1,086	386,102	355,526
1912	1,716	330,345	192,508	1937	1,137	412,205	362,537
1913	1,815	371,076	204,449	1938	958	335,180	349,874
1914	1,710	359,351	210,146	1939	1,007	380,801	378,153
1915	1,548	342,085	220,985	1940	1,046	423,001	404,398
1916	1,701	430,613	253,152	1941	1,159	536,388	462,802
1917	1,786	478,463	267,896	1942	1,291	748,486	579,772
1918	1,892	495,202	261,734	1943	1,375	905,982	658,896
1919	1,960	460,837	235,120	1944	1,434	931,912	649,868
1920	2,076	508,439	244,912	1945	1,439	867,800	603,057
1921	1,705	384,945	225,774	1946	1,378	724,451	525,726
1922	1,670	414,810	248,389	1947	1,371	749,822	546,916
1923	1,902	492,844	259,118	1948	1,345	723,552	537,956
1924	1,795	464,683	258,876	1949	1,209	699,377	495,762

*SOURCE: Annual Report on the Statistics of Railways (1949), p. 159, Table 155.

The very nature of the railroad industry may be held responsible for the ability of the rails to absorb widely fluctuating traffic loads with comparatively little variation in employment. The industry is characterized by decreasing costs arising from the fact that constant costs represent a large item of expense. It has been estimated that about two-thirds of railroad expenses are constant and one-third variable.[1] This is to say that costs very about one-third as much as business.

The constancy of railroad costs mirrors the high degree to which fixed capital contributes to the transportation process. The very nature of a railroad tends toward excess facilities. The plant must expand by large units; any capacity means great capacity. A track is required if only one train is to be operated, yet the track is capable of accomodating perhaps sixty trains.[2]

Similarly, the labor force has a high degree of "constancy". One train crew can operate a train of one-hundred cars as easily as it can a train of fifty cars. A switching yard can operate at capacity with the addition of relatively few men above its requirements to do any switching at all. A passenger train can be operated as easily and with as few men when filled to capacity as when half empty. As a result, the railroads can assume relatively heavy traffic loads with little variation in fixed capital or in labor.

While the course of railway employment has followed traffic, generally, the changes in the number of workers in most instances has been less than proportionate to changes in the volume of traffic.

[1] Truman C. Bigham, Transportation Principles and Problems (New York: McGraw-Hill, 1947), p.100.

[2] Ibid., p. 101.

This was particularly true during the years of the Second World War. From 1939 to 1944, traffic units increased 59.2 per cent, but employment rose only 29.8 per cent. From 1944 to 1949, traffic contracted 35.7 per cent while employment fell only 15.8 per cent.[1]

As might be expected, all of the variation in work to do is not met by changing the size of the labor force. Some of the change is met by increasing or decreasing the number of hours worked by employees. On the average a man puts in more time per month as traffic increases and less and less time as traffic declines. The number of man-hours worked rises and falls more rapidly than the number of workers. The number of hourly employees on the Class I, line-haul railways decreased 12.7 per cent from 1947 to 1949, but the man-hours paid for fell 17.3 per cent over the same period.[2] This holds true over even a shorter run period. From January of 1948 to January, 1949, traffic fell 9.8 per cent, the number of hourly employees fell only 5.2 per cent, but there was an 8.5 per cent drop in the total time paid hourly employees.[3]

The performances discussed above refer to all employees on the railroads. Many of these were engaged in making improvements in railroad property and not to current operations. Thor Hultgren has found that the percentage of wages charged to capital account became larger in every traffic expansion, and smaller in every contraction from 1921 to 1938.[4] From this the inference may be drawn

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1 Annual Report on the Statistics of Railways (1949) Table 155, p.159.

2 Annual Report on the Statistics of Railways (1947-1949), Table 155.

3 "Freight Train Performance of Class I Steam Railways", "Passenger Train Performance of Class I Steam Railways", and "Wage Statistics of Class I Steam Railways", Bureau of Transport Economics and Statistics, Interstate Commerce Commission. January, 1949.

4 Thor Hultgren, Am. Transportation in Prosperity and Depression (N.Y: National Bureau of Economic Research, 1948), Chap. 7, p. 182-3.

that time spent in construction and similar activity grew more rapidly in expansion and decreased more rapidly in contraction than did total man-hours or total labor force. Hence, the labor chargeable to operation must have risen and declined less rapidly than total time worked or total labor force, and traffic handled per mam or per man-hour of operating labor must have increased and decreased by larger percentages than is indicated by the overall data. Again, these phenomena are inherent in the nature of the industry. Deferred maintenance and repairs can be charged when income is low and made up when traffic and income are high.

Cyclical aspects and relationships aside, a marked trend toward more traffic per employee may be noted over the half century. The high levels of the war period cannot be expected to be maintained, but, barring a return of traffic to depression levels, it may safely be assumed that this measure of worker productivity will remain well above previous levels.

Many factors have been responsible for the greater output per worker. Certainly one of the factors has been the decline in the number of railroads. In 1900 there were 1,224 operating steam railroads in the United States; in 1949 there were only 431. This decline has been continuous since 1911 and reflects consolidation to a much greater extent than it does abandonment. The bulk of this decrease in operating entities has been at the expense of the shorter roads as the decrease in the number of companies operating over 1,000 miles of road has been only from the 1912 peak of 58 to the 1949 total of 42.[1]

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[1] Annual Report on the Statistics of Railways, (1949), Table 155, p.155.

The smaller, and probably less efficient, operating companies have been eliminated and the consolidations have served to reduce labor requirements. The Transportation Act of 1920 both facilitated and urged such consolidations and coordinations of services and facilities. The Interstate Commerce Commission followed the policy outlined in the Act and the carriers themselves took action toward that end. Many small-scale coordinations and consolidations of station facilities and the like were undertaken by the railroads as a method of retrenchment during the early 1930's.

The full force of this movement on the part of the roads was not felt by railway labor immediately. In 1930, the Senate of the United States passed a bill vesting in the Interstate Commerce Commission the power to include in any order it might enter approving consolidations such terms and conditions necessary to protect employees against injury resulting from the consolidations. The Emergency Railroad Transportation Act of 1933, which established a Federal Coordinator of Transportation who was empowered to require action to avoid unnecessary duplication of services and facilities, also protected employees. Section 7b of that Act provided that the number of employees in the service of any carrier should not, by reason of any action taken under the statute, be reduced below the number on the payrolls at the time of enactment, nor should any employee be deprived of employment or placed in a worse position with respect to his compensation by such action.[1]

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[1] 73rd Congress, 1st Session, Chap. 91, 48 U.S.Statutes-at-Large, Part I, p. 211 ff.

This protection given labor served largely to nullify the savings to be expected from coordinations and only a few relatively minor changes were made under the Act. The Coordinator Section of the Emergency Act expired in 1935. The labor organizations immediately began negotiations with the carriers to extend the job protection provisions by a collective agreement. The negotiations resulted, in May of 1936, in the Washington Job Protection Agreement between virtually all of the Class I carriers and all of the railway labor organizations.

The Washington Agreement provided that whenever a coordination or consolidation of facilities or services was effected between two or more carriers, all employees who were displaced should receive a displacement allowance based on length of service. This allowance was payable monthly at the rate of sixty per cent of the average monthly compensation of the employee at the time of displacement. In the case of employees of fifteen or more years service, the allowance was to continue for five years. The duration of payment was scaled downward for shorter service men. Employees who were downgraded as a result of consolidation or coordination were to be paid not less than their old rate for a period of five years.[1] Similar protection features were written intc the Transportation Act of 1940.

The protection features of the Washington Agreement and of the 1940 Act prevent any severe, immediate displacement of employees by consolidations and coordinations. The Interstate Commerce Commission is empowered, as well, to include in abandonment orders conditions for the purpose of protecting displacedemployees.[2]

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[1]Wages and Labor Relations in the Railroad Industry, 1900-1941 (Privately printed by the Executive Committee of the Bureau of Information of the Eastern Railways), pp.95-6.

[2]Ibid., p.97.

In the long run, however, there can be no doubt that the tendency toward fewer companies has led to fewer employees.

Other legislative factors also served to temper the winds of displacement. Many states have enacted what are known as "Full Crew Laws". These laws specify a minimum number of employees for each train--within certain limits. An example of such legislation in the New York law, enacted in 1921, which required minimum crews for all trains operating outside of yard limits on railways more than fifty miles in length. In each case, the crew, by law, had to consist of one engineer, one fireman, and as many conductors and brakemen as will provide a minimum crew of five for freight trains of twenty-five cars or less, and six men for trains of over twenty-five cars. The Nevada law requires four men on a passenger train of two cars or less and five men on a train with three cars or more.[1] These laws are typical of the requirements of the twenty states which have had, at one time or another, such laws on their statute books. Inevitably, many of the provisions of such laws have come to be included in collective bargaining agreements. This effectively prevents the carriers from taking full advantage of any circumstances or developments which would permit the reduction of crews in train and engine service.

Technological advance has been responsible for much of the decline in employment and increase in productivity. The increasing mechanization of maintenance work, the installation of modern switching yards, the use of more powerful motive power, etc., have all combined with other changes in operation, signaling, and clerical

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[1]Julius H. Parmelee, The Modern Railway (New York: Longmans, Green and Co., 1940), pp. 432-3.

methods to reduce the quantity of labor required for a given amount of traffic. There is no necessity to examine these in detail here, but, as the diesel-electric locomotive represents a continuation of the trend toward more powerful motive power, the past trends in motive power should be examined in this connection.

The amount of freight behind an engine typically becomes larger as traffic expands and smaller as traffic contracts. In spite of this cyclical variation there has been a fairly consistent upward trend in the size of train-loads from the early 1890's to the present.[1] This great cumulative increase was made possible by the adoption of progressively more powerful locomotives. Until shortly before 1900 the increase in power was obtained by the installation of larger and larger locomotives. Then designers turned their attention to the construction of locomotives with larger fireboxes. Until that time, the width of fireboxes had been restricted by the width of the engine frame or the distance between the high driving wheels. This restriction was avoided by the addition of a trailing truck of small diameter wheels behind the driving wheels. A wider firebox could be placed over this trailing truck. This growth in the size of fireboxes, however, created the problem of keeping the larger fire supplied with fuel. In an effort to solve this problem as well as to produce more power with the same size firebox, automatic, mechanical stokers were introduced beginning in 1903. A stoker could supply coal faster than a fireman could. By 1925 the mechanical stoker was in common use.[2]

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[1] Hultgren, op. cit., p.97.

[2] R. P. Johnson, op. cit., p. 84.

The superheater was adopted. This increases the heat content and reduces the water content of the steam, reducing the quantity of coal which must be burned to obtain an equivalent amount of power. The superheater first appeared about 1910, and resulted in an increase in the tractive effort of locomotives.[1]

Another design advance which increasedthe power obtained per ton of coal fired and resulted in more powerful locomotives was the feedwater heater. This device pre-heated the water before it was introduced into the boiler of the steam locomotive and, hence, reduced the time necessary for that water to produce steam. The feedwater heater appeared about 1918.[2]

The use of the locomotive booster, an auxiliary engine used only in starting or at low speeds, also began about 1918. However, by 1934, only slightly over eight per cent of the steam locomotives in the country were equipped with boosters.[3]

The use of higher steam pressures in the boilers of locomotives, made possible through the use of alloy steel in their construction, began about 1928.[4] Higher pressures resulted in more powerful locomotives; a reduction in the number of locomotives required to handle a given weight of traffic followed.

Trains usually are drawn by a single locomotive, but double-heading is not uncommon with weaker motive power, particularly in hilly territory. The use of helper locomotives or of second locomotives on heavier trains is reflected in the ratio between locomotive

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[1]Ibid., p. 49

[2]Ibid., p. 123

[3]Annual Report on the Statistics of Railways (1934), Statement No.8-A, p. S-13.

[4]Rultgren, op. cit., p. 98.

miles in trains and train miles. Between January 1, 1920 and December 31, 1939 this ratio was never higher than 1.08 in any month or lower than 1.05.[1] This would indicate that the increasing power of locomotives accompanied and was responsible for the rise in train weight.

TABLE VI

AVERAGE TRACTIVE EFFORT OF ALL LOCOMOTIVES*

Year	Effort LBS	Year	Effort LBS	Year	Effort LBS	Year	Effort LBS	Year	Effort LBS
1903	21,781	1913	30,258	1923	39,177	1933	46,916	1943	52,451
1904	22,804	1914	31,006	1924	39,891	1934	47,712	1944	52,822
1905	23,666	1915	31,501	1925	40,666	1935	48,367	1945	53,217
1906	24,741	1916	32,840	1926	41,866	1936	48,972	1946	53,735
1907	25,781	1917	33,932	1927	42,798	1937	49,412	1947	54,506
1908	26,356	1918	34,995	1928	43,838	1938	49,803	1948	55,170
1909	26,601	1919	35,789	1929	44,801	1939	50,395	1949	56,333
1910	27,282	1920	36,365	1930	45,225	1940	50,905		
1911	38,291	1921	36,935	1931	45,764	1941	51,217		
1912	29,049	1922	37,441	1932	46,299	1942	51,811		

*SOURCE: Annual Report on the Statistics of Railways (1949) p.155, Table 155.

The steady rise in the tractive effort of steam locomotives indicated in Table VI led to the ability to handle trains of greater weight with a single locomotive. This has necessitated fewer trains for an equivalent quantity of traffic. As a result, train miles run per employee have not increased although traffic units per employee have risen (Table V).

The more powerful motive power of recent years permitted the carriers to handle the huge traffic of the war years with comparatively little increase in train miles. The peak traffic year of 1944

[1] Ibid., p. 97.

TABLE VII

RAILWAY EMPLOYMENT AND TRAIN MILES*

Year	Workers	Total Train Miles	Miles per Worker	Year	Workers	Total Train Miles	Miles per Worker
	000	000					
1900	1,018	856,014	841	1925	1,786	1,217,800	682
1901	1,071	877,115	819	1926	1,822	1,240,761	681
1902	1,189	905,324	761	1927	1,776	1,210,777	686
1903	1,313	951,454	724	1928	1,692	1,193,449	705
1904	1,296	975,556	753	1929	1,694	1,200,239	709
1905	1,382	1,006,251	728	1930	1,517	1,101,727	726
1906	1,521	1,073,044	706	1931	1,283	967,679	754
1907	1,672	1,139,324	681	1932	1,052	827,789	787
1908	1,436	1,093,164	761	1933	991	792,801	800
1909	1,503	1,074,866	715	1934	1,027	822,529	801
1910	1,699	1,184,466	697	1935	1,014	831,709	820
1911	1,670	1,199,425	718	1936	1,086	905,340	834
1912	1,716	1,198,199	698	1937	1,137	933,019	821
1913	1,815	1,236,902	682	1938	958	829,535	866
1914	1,710	1,213,084	709	1939	1,007	856,153	850
1915	1,548	1,132,452	732	1940	1,046	886,537	848
1916	1,701	1,227,745	722	1941	1,159	981,579	847
1917	1,786	1,239,740	694	1942	1,291	1,107,248	858
1918	1,892	1,172,757	620	1943	1,375	1,177,246	856
1919	1,960	1,113,646	568	1944	1,434	1,187,698	828
1920	2.076	1,194,333	575	1945	1,439	1,145,785	796
1921	1,705	1,088,059	638	1946	1,378	1,050,300	762
1922	1,670	1,098,405	658	1947	1,371	1,042,604	761
1923	1,902	1,238,918	651	1948	1,345	1,004,819	747
1924	1,795	1,203,527	671	1949	1,209	888,620	735

*SOURCE: Annual Report on the Statistics of Railways (1949), Table 155, pp. 158-9.

had slightly less than twice as many traffic units as did 1924 (931,912,000,000 vs. 464,683,000,000) but 1944 required fewer train miles to transport the much larger traffic load. This was not a reflection of shorter hauls, as both the average passenger journey and the average freight haul were longer in 1944 than in 1924. The performance must be ascribed to heavier loads per train. The capacity of the average freight car had increased from 44.8 tons to 50.8 tons over this period, and the tractive effort of the average locomotive had increased from 39,891 pounds to 52,822 pounds.[1]

The decrease in the number of trains required to transport a given quantity of traffic was particularly important in its effect upon the employment and productivity of train and engine service employees. The workers in this group, which includes conductors, baggagemen, brakemen, engineers, and firemen, are directly affected by any reduction in the number of trains operated. Heavier trains reduce the employment opportunities for this group.

The work of train and engine service employees may be apportioned between freight and passenger traffic to a degree impossible with most other employees. The mileage of "mixed" trains, containing both freight and passenger cars, is a very small percentage of total mileage and may be disregarded.

The increases in efficiency noted in connection with all employees are particularly striking when train and engine service workers alone are considered. In 1921 one hour of freight crew labor paid for was required for about 850 tons-miles of freight. In 1937 about 1,450 ton-miles resulted from the payment for one hour, and in 1949 the figure had increased to about 1,780. Historically, this productivity has tended to vary directly with traffic to a certain extent. It has increased perceptibly in most expansions of traffic and even in some contractions---though to a lesser degree.[2]

[1] Annual Report on the Statistics of Railways (1949), Table 155, p.155.

[2] Hultgren, op. cit., p.192, and Annual Report on the Statistics of Railways (1949), Table 69, Table 44, p. 39.

Some roads have taken advantage of the more powerful motive power by running all through freight trains on an "extra" or non-scheduled basis. Cars are accumulated until the weight limitations of the locomotive for that particular run are reached and then a train of maximum weight is dispatched. In the past, when freight trains were made up and sent out at more regular intervals, the employment of freight train crews was a function of time to a greater extent and of available traffic to a lesser extent than after the advent of more powerful locomotives.

Insofar as the diesel-electric locomotive represents a more powerful form of motive power, it will facilitate the increase in productivity of freight train and engine employees. This question will be examined in detail in a following chapter.

There has been no persistent upward trend in productivity in passenger service. The technological factors which were operating in freight service were opposed in passenger service by a downward trend in passenger traffic. There has been, however, an increase in productivity in every expansion of passenger traffic and a decrease in every contraction.[1] Productivity per hour paid train and engine employees in passenger service followed this pattern during the huge wartime expansion in traffic, however the decline in productivity accompanying the post-war traffic decrease has been to levels above the pre-war period.

The necessity to operate scheduled passenger trains regardless of the level of traffic prevents the carriers from taking full advantage of motive power developments in passenger service. As a

[1] Hultgren, op. cit., p. 194.

result, the productivity of passenger train and engine service workers has not kept pace either with freight developments or with motive power advances.

It is recognized in business and industry generally that overtime work increases and decreases more rapidly than other work. In the railway industry there has been a general relation between the cycles in traffic and the ratio of overtime hours to total hours. This ratio for all hourly employees fell in all the contractions from 1921 to 1941 and rose in all periods of traffic expansion but there has been no discernable trend.[1]

The system of payment for train and engine service employees is peculiar to the railroad industry. Road passenger and road freight train and engine workers receive pay for either mileage or hours, whichever is the greater. In through passenger service, employees are paid on the basis of a day's pay for a run of 100 miles or less. Twenty miles per hour is used as the base for determining the hours of work for a day's pay so that five hours is allowed for the completion of 100 miles. Payment is made for mileage in excess of 100 miles, even when it is completed within the five hours allotted. If a passenger service employee makes his assigned run in less than the theoretical time allowed at 20 miles per hour, he is paid according to the mileage. If it should take him longer than the theoretical time, he is paid according to the hours --on a pro rata overtime basis. It is possible for these employees to receive overtime either for service beyond five hours or beyond 100 miles. However, only service over the time limit is paid for at time and one-half rates. A trip

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[1]Ibid., p. 194.

of 125 miles made in four hours would result in payment for one and one-quarter days. A trip taking six hours would be paid at the rate of six and one-half hours.[1]

In addition, some wage contracts provide that the employee must receive specified minimum aggregate earnings in the month. In road freight service a similar system is used, but the allowances are computed on the basis of twelve and one-half miles per hour, with overtime and punitive overtime paid for runs of over 100 miles or eight hours.[2]

This system of computing earnings results in train and engine service employees being paid for hours not worked. The dual basis of payment does not penalize train and engine workers fully for increases in speed because their payment is a function of distance, as well as of time. However, increases in speed do result in a reduction of punitive overtime payments. The trend in the ratio of overtime hours to total hours worked for train and engine service employees has been down, despite the fact that no such trend is visible for all hourly employees. In freight service the decline from 1923 to 1932 was virtually continuous and quite severe, with overtime about 16 per cent of total man-hours worked in the earlier year and about six per cent in the latter. The increase in traffic in the middle thirties and during the war years sent this ratio upward again. In December 1949 in freight service overtime represented about 12.7 per cent of total hours worked and about nine per cent of total hours paid for.

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[1]Julius H. Parmelee, The Modern Railway (New York: Longmans, Green and Co., 1940), p.460.

[2]It is interesting to note in this connection that in the year 1949 train-miles per train-hour in passenger service averaged 37.0 miles and in freight service, 16.9 miles.

The picture in passenger service has been similar. As speed has increased, overtime payments have decreased. The decline has been almost continuous in the ratio between overtime and time worked or time paid for. Expansions in passenger traffic have served only to reduce the rate of decline. In December of 1949, overtime was 7.6 per cent of total time worked and about 4.4 per cent of total time paid for.

The system of payment also results in time paid for but not worked. The changes in the ratio between overtime and time worked or time paid for are overcome to a certain extent by counter movements in time paid for but not worked. As traffic increases, time paid for but not worked tends to decrease. Actually, the ratio between hours paid for but not worked and total hours paid for has been rising historically. However, periods of traffic expansion have slowed this rate of increase. In periods of traffic decline, the ratio has risen at a faster rate than in periods of traffic increase. This is true for all hourly employees as well as for train and engine employees alone.

Man hours paid for but not worked as a percentage of total hours paid for rose throughout the 1920's and thirties for all hourly employees. The war time traffic expansions slowed the rate of increase considerably. From 1934 to 1949 the ratio increased an average of .24 per cent a year, from 5.6 in 1934 to 9.6 in 1949. The train and engine service workers saw no such advance. The payment methods account for a much higher level for this ratio for train and engine employees, but traffic expansions have served to slow the growth. In 1934, man-hours paid for but not worked represented 22.4 per cent of total hours paid for. By 1939, this had fallen to 20.1 per cent. in 1944, the ratio was again 20.1 per cent, but by 1949 it had risen to 23.7 per cent.

This phenomenon is, in large measure, the result of increases in train speed. Some trips that formerly required ten hours can now be made in eight hours, some seven hour runs now require only six hours. Higher speeds reduce the percentage of overtime in some circumstances and increase the percentage of time paid for but not worked in other circumstances, and for much the same reasons. A time reduction from ten hours to eight reduces the amount of overtime. A reduction from seven hours to six hours increases time paid for but not worked.

The percentage relationship between hours paid for but not worked and total hours paid for has been little affected by variations in traffic in passenger service. Again, the compulsion to serve, to operate passenger trains, even in the fact of declining traffic, has entered in. The elimination of many passenger train stops because of traffic declines and a desire to speed up schedules has resulted in faster runs over longer distances. This has contributed to increasing time paid for but not worked. The rise in the ratio of this time to total time paid for has been virtually continuous in passenger service.[1]

Employees directly engaged in transportation do not constitute the majority of railway employees. Only about thirty-six per cent of the hourly paid workers are in transportation service and only twenty-three per cent of the total are in train and engine service.

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[1] Hultgren, op. cit., p.202.

Twenty-eight per cent are charged to the maintenance of equipment and stores, twenty-one per cent to the maintenance of way and structures, and fifteen per cent to professional, clerical, and general pursuits.

About half of the railway workers are employed in maintenance work with most of these concerned with equipment and stores. Generally speaking, maintenance is deferred in periods of traffic contraction. Cars in bad order are permitted to accumulate, repairs on locomotives not in use or not required are not performed. Hultgren has found[1] that the number of unserviceable freight cars has increased in almost all periods of traffic contraction. This is to say that the amount of equipment rendered unserviceable exceeded the number retired or repaired. Equipment was not repaired as fast as it became unusable.

It may be assumed that in periods of traffic contraction the number of cars falling into disrepair decreases as the amount of use decreases. Hence, repairs could be reduced to a certain extent without any accumulation of bad order cars. Since the number of unserviceable cars has increased in times of decreasing traffic, it follows that maintenance of equipment has been reduced proportionately more than traffic fell. The reverse is true in periods of traffic expansion as the number of unserviceable cars falls proportionately more than traffic increases.

A variety of factors enter into managerial decisions in this area. The desire to reduce expenses as revenue declines, the fear that the next expansion of traffic may not be great enough to require

[1]Ibid., pp. 169-75, passim.

all of the equipment on hand, the realization that bad order equipment can be repaired quickly so as to provide for rises in traffic all play a part in the decision to defer maintenance.

Similar reasoning applies to the maintenance of way and structures. It is obvious that an unserviceable section of track must be repaired if any trains are to operate over it. However, the general condition of the roadbed, ties, ballast, and structures can be allowed to deteriorate within the limits of safety. That the limits permitted for safe and efficient operation are not broad is indicated historically by the fact that maintenance work tended to decline relatively to traffic in expansion, and to increase relatively to traffic in contractions.

In terms of maintenance man-hours paid for per traffic unit, the trend has been down. This does not necessarily reflect any decline in maintenance work over time but rather an increase in the mechanization of such work. Some technological advances have tended to reduce the deterioration of equipment and plant and others have enabled maintenance forces to make repairs in less time. Better rails, ties, and hardware have reduced the necessity for track maintenance. The growing use of power machines for cleaning and placing ballast, tamping ties, driving spikes, etc., has speeded maintenance work and reduced the labor requirements.

In summary, historically productivity in the railway industry has increased. Traffic units per worker have risen overall. Employment has borne a definite relationship to the volume of traffic, but changes in employment have been less than proportionate to changes in the volume of traffic. Hours paid for have varied more widely than the number of workers and changes in hours provide most of the response to changes in traffic volume.

More powerful locomotives have reduced the number of trains and train miles necessary to haul a given volume of traffic. This has resulted in fewer employees for a given traffic load and has accounted in large part for increases in productivity.

Greater speed has reduced the number of hours of work necessary to move a given volume of traffic. The unique payment system on the railroads for train and engine employees has resulted in a decline in overtime payments but in an increase in time paid for but not worked as train speeds have risen.

Consolidations and some improvements in efficiency of operation have not been permitted to exercise their full effects upon railway workers. Job protection has been given by law and by collective agreements.

The impact of the diesel-electric locomotive upon these trends and relationships will be examined in later chapters. From the foregoing, however, it is obvious that railway labor has been in the grip of technological changes which have significantly altered the employment opportunities for railway labor. Many of these changes have been in the area of improved motive power. To the extent that the diesel is merely a continuation of the trend toward improved motive power, it does not mark any sharp break between the new and the old nor a new problem in technological displacement.

III. ENGINE SERVICE EMPLOYEES

A. The Job.

Since the early days of railroading the engine crew of a railway locomotive has consisted of an engineer, responsible for the operation of the locomotive, and a fireman who, under the jurisdiction of the engineer, has been responsible for the production of power. When the fireman has not been so engaged, he has assisted the engineer in the observance and calling of signals.

In steam locomotives of any description the duties of the fireman in producing power have been well defined. He has thrown in the wood, or shoveled in the coal, or operated the mechanical stoker or oil pump in oil burning steam power. In the diesel, this function has disappeared. The fuel is burned in the cylinder of the diesel engine. It is supplied to the cylinder by continuously operating pumps drawing from a fuel tank. Control of the flow of fuel is in the hands of the engineer, regulated by the throttle which he controls.

The operating duties of the fireman, those concerned with actual train operation, have not changed. He is still charged with observing and calling signals and otherwise assisting the engineer in the operation of the train.

The function of the engineer has changed little with the advent of the diesel-electric locomotive. He governs the power that is produced by the locomotive and utilizes that power to propel the train over the road. It is immaterial whether that power be produced by a fireman's throwing coal into a firebox, by a fireman's admitting oil through a valve, by dynamos at a central power station, or by combustion within the cylinders of a diesel motor.

In addition to his functions concerned with power, the engineer is concerned with train operation. He must observe the track ahead, grade crossings, signals, train orders, time card regulations, and general train movements. Historically, he has also been responsible for the general supervision of the fireman and for road repairs to the locomotive.

The means by which the engineer exercises control over power and train movements have changed somewhat with the diesel. The controls on the new locomotive consist of the conventional air brake valves, sander equipment, whistle cord and bell ringer— all familiar from steam locomotive practice. In addition two levers are employed to control the movement of the engine. One of these is the throttle, easily manipulated, which controls the speed of the diesel engine. The second control is electrical and has substantially the same functions as the controller on a street car. This governs forward and backup movements, having series, parallel, and shunt electrical contact positions to be used at different speeds and under varying power requirements. In freight service, usually an additional control over dynamic braking is provided.

The controls are arranged so that all of the engines in the locomotive and all of the individual units which may be coupled together function as one locomotive controlled from the engineer's position.

On road locomotives the engineer's position is provided with a safety feature, either a foot pedal or part of the brake valve which must be kept in a certain position by a positive action of the engineer. In the event that the operator should become incapacitated while the locomotive is in motion, the release of pressure on the safety control would cause the motors to be brought down to idling speed and the brakes to be applied automatically. This is commonly known as a "dead man control".

Numerous gauges and signals relating to the condition and operation of the locomotive are on a panel in front of the engineer. He relies upon these for information about the performance of the locomotive under his charge.

The functions of the engineer are so many and his importance so great that the actual performance of his job has not been threatened by the diesel-electric. In the early days of the use of internal combustion motors on the rails, members of the shop crafts were used as operators. The settlement of the jurisdictional disputes which arose out of this practice was in favor of the engineers and the operation of motive power by members of that craft has not since been seriously challenged. The jurisdiction of the engineers is well established. Whenever a locomotive is operated for the purpose of moving a train, that operation is performed by an engineer.

The security of the fireman in the new situation is less well established and has been created only by the action of his labor organization. It was not the intention of many of the carriers to employ a fireman on the early road diesel locomotives. The diesel-electric evolved out of the earlier applications of internal combustion motors to the rail-car field. Rail-cars were not held to be locomotives for purposes of crew assignment, even under the national agreements with the labor organizations representing the firemen and engineers. The main point of distinction was that a portion of the rail-car was devoted to revenue traffic; the car itself might or might not draw other cars but was not regarded as a locomotive. Much of the attraction of the rail-cars for the carriers lay in the fact that they could be and were operated by one man.

The railroads regarded the early diesels as rail-cars and assumed that they would be operated with only one man on the locomotive. This was one of the selling points of the diesel builders. R. M. Dilworth, Chief Engineer of the Electro-Motive Division of General Motors Corporation, the leading diesel builder, has testified that his organization had begun as manufacturers of rail motor cars sold as a substitute for the small, branch line steam trains. The older steam power in use on such runs was very inefficient and could be replaced with profit even by the gaoline burning rail motor car. One of the savings was in manpower. Mr. Dilworth has said, "They could operate a motor car with one man in the engine room, and if the branch line depended on motor cars and there was no steam, we could shut down the coal docks and water stations and generally reduce the cost of operation of the branch line."[1]

The earliest road diesels were sold to service a new type, extremely fast, light weight train. Some of the carriers attempted to operate without a fireman and some did not. Since the streamline trains began operation on the Union Pacific and Burlington Lines, it was inevitable that the questions of jurisdiction should first arise there.

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[1]<u>Transcript of Proceedings</u> in so-called "Diesel Case", Vol. 22, p.2338.

A fireman was assigned to the streamlined Union Pacific trains at the instance and request of the engineers. His duties and responsibilities were determined and agreed upon by a joint conference of representatives of both the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen with the Union Pacific Railroad. It was asked that the firemen receive special mechanical training so that he could be in charge of the engineroom. The agreement provided:[1]

> Helpers will be taken from the ranks of firemen and it will be their duty to give necessary attention to the motor generating equipment, air conditioning, heating, lighting and other appurtenances throughout the train while enroute.

This agreement was signed on November 17, 1933, and assigned to firemen mechanical duties in the engine rooms of streamline trains.

About a year later the Brotherhood of Locomotive Engineers made a demand for a second engineer on this new type power. The Brotherhood maintained that the second engineer was required to handle and manipulate the operating controls of the locomotive. It was held to be unreasonable to expect one man to sit for several hours in a seat he could not vacate. The safety of the train, it was claimed, required that a second engineer be available in order to substitute for the engineer when the occasion required. This demand was rejected by the Union Pacific

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[1] The agreement is described in detail in: Brief of the Carriers, <u>Transcript of Proceedings</u>, Engineers' Diesel Case, p. 1166.

At about this same time the firemen were attempting to secure an agreement from the Burlington to provide for the assignment of a fireman to the Pioneer Zephyr trains, the name given to the earliest Burlington diesel trains. The firemen were successful only after a strike threat. It was not until December 9, 1935, that an agreement with the firemen was reached. Until that time the Burlington had operated its Zephyrs for slightly over a year with only one man in the locomotive cab. At least five streamlined trains were in service, all of which were being successfully operated by one engineers and without a fireman.

The December 9, 1935, agreement provided that a man be taken from the ranks of the firemen to serve on the diesel trains. Paragraph two of this agreement was as follows:[1]

> (2) That such Firemen (Helpers) shall have duties as follows: inspection of and attention to motor, generator, heating, lighting, and air-conditioning equipment during their trip and shall be subject in all respects not inconsistent with the foregoing to all rules and working conditions as set out in the existing schedule.

The engineers raised no objection to this and the firemen began an attempt to secure jurisdiction from the New England roads. Negotiations were entered into with the New York, New Haven, and Hartford, the Boston and Maine, and the Maine Central Railroads for the assignment of firemen to diesel yard and road locomotives then operated in New England with only one man in the cab.

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[1] Ibid., p. 1167.

The negotiations with the New England roads were successful and in June 1936 agreements were concluded with the New England carriers which provided for a fireman in the cab of diesel-electric locomotives. These agreements set forth the duties of the fireman (helper) in much the same terms as had the Western agreements, with regard to the inspection and attention to the motor, generator, heating, light and air conditioning equipment during the trip, and also specified "such other duties as may be reasonably and usually performed by firemen (helpers) on diesel electric engines or diesel electric streamline trains."

The New England agreements marked the end of joint action on the part of the firemen and engineers. Near the end of 1936 the two organizations began a contest to secure additional employees on the diesel-electric locomotives. The firemen started a national movement to secure a fireman (helper) on diesel locomotives about the end of October 1936. This was a movement for a single fireman in the cab of all diesel locomotives. This movement culminated in the so-called "National Diesel-Electric Agreement" between the B. L. F. and E. and most of the American railroads and which dealt with the assignment of firemen (helpers) on locomotives other than steam. This was signed on February 28, 1937, and became effective on March 15, 1937.

The agreement provided that after the effective date a fireman (helper), taken from the ranks of the firemen, should be employed on diesel-electric, oil-electric, gas-electric, other internal combustion, or steam-electric locomotives on stream lined or main line through passenger trains. The term "main line through passenger trains" was defined so as to include only trains which made few or no stops. In addition, a fireman was to be employed on any "diesel-electric, oil-electric, gas-electric, other internal combustion, steam-electric, of more than 90,000 pounds weight on drivers."[1] The agreement further provided that steam rates of pay should apply to firemen employed under the agreement. Roads using both coal and oil burning steam locomotives were to pay the slightly higher coal rate; roads using only oil burning steam locomotives were to pay the oil rate; and roads using only coal burning steam locomotives were to pay the coal rate. A fireman was to be used on all switching engines weighing over 90,000 pounds.[2]

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[1]Section III of the agreement made specific exceptions to the general rule and is here quoted:
"The term 'locomotives', as used ...does not include any of the following: (a) Electric car service, operated in single or multiple units. This service is definitely excluded from the terms of the agreement. (b) Gasoline, Diesel-electric, gas-electric, oil-electric, or other rail motor cars, which are self-propelled units (sometimes handling additional cars) but distinguished from locomotives in having facilities for revenue lading or passengers in the motor car; except that new rail motor cars installed after the effective date of this agreement which weigh more than 90,000 pounds on drivers shall be considered 'locomotives" .... If the power plants of existing rail motor cars be made more powerful by alteration, renewal, replacement, or any other method, to the extent than more trailing units can be pulled than could have been pulled with the power plants which were in the rail motor cars on the effective date hereof, such motor cars, if then weighing more than 90,000 pounds on drivers shall be considered 'locomotives', as provided.... (c) Self-propelled machines used in maintenance of way, maintenance of equipment, stores department, and construction work.... This will not prejudice local handling on individual railroads where disputes arise as to whether or not the character of work performed by these devices constitutes road or yard engine service."

[2]"Memorandum of Agreement", in: General Wage and Rule Agreements, Decisions, Awards, and Orders, 1907-1941 (Cleveland: Brotherhood of Locomotive Firemen and Enginemen, 1949), pp. 571-2.

The National Diesel-Electric Agreement determined the pattern of subsequent diesel-employment. The carriers estimated that this agreement resulted in the assignment of approximately two hundred and thirty additional helpers and an increase of $445,000 in payrolls for the diesel-electric power in use on March 16, 1937.[1]

The introduction into the cab of the diesel of another man required extensive changes in design. The builders had assumed one-man operation and that the fewest possible functions required of the operator resulted in the most satisfactory operation of the locomotive. Simplicity of control and reduction to a minimum of the duties of the operator was fundamental in their engineering and held to be the most economical. Most of the apparatus on the diesel was designed to be controlled automatically with mechanical and electrical devices.

With one-man operation, control of the locomotive had been placed entirely in the hands of the engineer. After a fireman (helper) was required as a part of the crew, the carriers requested the elimination of a few of the automatic controls and required that their function be made manual. The builders did this gradually until, essentially, four functions were the responsibility of the fireman: (a) Control of the engine radiator shutter which determines the amount of air admitted for engine cooling purposes. This must be changed with variations in the temperature of the outside air and the labor of the locomotive. (b) Reversing the fuel strainer at intervals of approximately one hour. (c) Cleaning the train heating steam generator at intervals. This is normally

[1]Testimony of F. G. Gurley, Vice President of the Atchison, Topeka and Santa Fe Railroad, in: Transcript of Proceedings in so-called "Diesel Case", Vol. 19, p. 1798.

done by depressing a foot pedal. (d) Operating the stack or soot blower on the heating generator at intervals, which is also done with a foot pedal.[1] There are no facilities required for train heat in freight service, and the last two of the functions were limited to passenger train service only.

These functions were from a locomotive operating point of view. The fireman retained his train operating duties. In addition many of the railroads gave other, non-functional duties to the fireman. These included making reports, tours of inspection, the recording of meter readings, etc. In the effort to provide occupation for the fireman required by the Agreement, some of the carriers went to odd lengths.

A fireman in diesel service described his duties in some detail to the 1943 National Railway Labor Panel Emergency Board. Immediately on the train's arrival at Omaha he had to go to the front of the engine and put up numbers identifying the train. Then he had to read the orders relating to the movement of the train over the road. He then had to go to the engine room and check all of the oil levels in each individual diesel motor. This had to be done while the motors were idling, a period of short duration as the train remained there only long enough to refuel and inspect the train, load the mail and load the passengers.

As the train left Omaha the fireman normally returned to the engine room and adjusted the ventilators that control the water temperatures of the various diesel motors. At the same time he

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[1]Testimony of R. M. Dilworth, loc. cit., Vol. 21, p. 2228.

would note all of the gauges indicating fuel pressure, oil pressure, temperature, etc. During this tour he would also note that all valves were in proper position.

In multiple unit operation this procedure would be repeated in each of the units. The train heat boiler and the stack for the boiler had to be attended to about every twenty minutes. A jet of steam was used to blow the soot out of the boiler stack. Water would be blown down into the boiler to clean it, an operation which was performed on the same inspection trip.

In the second unit the air reservoirs had to be blown out to prevent the accumulation of moisture, the same gauges checked, and ventilators adjusted. In all, this first patrol would take from 35 to 40 minutes as the same checks would be made on his way back to the front of the locomotive. The fireman was expected to listen for any unusual noises, pounds, or knocks as he passed the motors. Each stack had to be felt with the hands to see that each cylinder was firing.

The fireman would then go into the cab to see if the engineer needed or wanted anything. If not, he returned immediately to the engine room. Inspection trips after the first required approximately twenty minutes.

Concerning his train operating duties, the witness said:

> I spend no time watching signals .... We have a few engineers who will demand us to be in the cab at certain points, such as through yard limits, where there are train order boards, but he will tell you.... We are instructed to stay out of the cab.[1]

[1] Testimony of L. J. Fry, employee of the Union Pacific Railroad, loc. cit., Vol. 7, pp. 944-51.

Some of the railroads required the fireman to note and to write down the various gauge readings and other details of his inspection tours. Others required the fireman to be in the cab to observe signal indications in certain territory. Still others placed the fireman under the orders of the engineer who could direct him to remain in the cab or to make tours as circumstances dictated.

At about the same time that the firemen had secured the diesel agreement with the carriers, in the Fall of 1936 and in 1937, the engineers made their first formal demands for the employment of an additional engineer on diesel locomotives. These demands were served upon and denied by six Western railroads. Over the next few years demands were served for the assignment of assistant engineers to the engine rooms of diesel locomotives by the Brotherhood of Locomotive Engineers upon various railroads in the country. By March, 1941, the engineers had served 52 railroads with formal notices for the placing of additional engineers on diesel locomotives.

On May 10, 1941, the Brotherhood of Locomotive Firemen and Enginemen served demands on the railroads for the employment of additional firemen on diesel locomotives. The B. L. E. was now seeking at least two engineers on most road diesels and the B. L. F. and E was seeking at least two firemen on most road diesels.

B. The First Diesel Case

The demands of the two organizations were formulated as separate—not joint—demands. The Emergency Board eventually created to hear the dispute between the two Brotherhoods and the carriers said in its report:

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[1] Report of Emergency Board Appointed February 20, 1943, (Washington: Government Printing Office, 1943), pp. 49-50.

> Apparently, realizing the untenable character of their original requests, the brotherhoods made an effort to reconcile conflicting interests and to present a joint program with regard to... the manning of diesels.... Their efforts proved unsuccessful, however, and their separate demands were progressed independently until they reached this Board.[1]

In its report the Board further noted that at the opening of the engineers' case they had modified their request to provide that only one additional man, to be designated an assistant engineer, be placed on single- and multiple-unit assemblies up to and including four units. Subsequently, the fireman, too, modified their request to provide that only one additional fireman be employed on multiple-unit diesels up to four units. "Both organizations," said the Board, "concede that only one additional man is necessary, but each claims the right to that job. This, of course, precipitates a sharp juridictional issue."[2]

The Board decided that the firemen should first present their case, the engineers should then present their case, and the carriers should present their case jointly in reply to the brotherhoods. The hearings of the Board extended from March 1 to April 20, 1943. All parties were given opportunity to present such evidence, submit such exhibits, and make such arguments as they wished and to rebut, examine and cross-examine witnesses. Oral arguments were presented and briefs were filed by the parties. The record constituted 6,814 pages of testimony and argument.[3] This hearing represented the

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[1]Report of Emergency Board Appointed February 20, 1943, (Washington: Government Printing Office, 1943), pp. 49-50.

[2]Ibid., p. 50

[3]Ibid., p. 3.

first real inquiry into the problems raised by the diesel locomotive for the engine service employees.

The engineers based their case for an additional engineer upon two contentions: (a) Any job in the engineroom of the diesel-electric belonged to the engineer by custom, tradition and inheritance, and (b) for reasons of safety the fireman should be at the side of the engineer at all times the train is in motion.

The brief for the engineers declared, "The engineer has always been in charge of and has had the responsibility for the engine." It was held that in the switch to the diesel, the engineer should normally be permitted to take his rightful place in the engine room. "The equipment and appurtenances of the diesel locomotive would naturally come within the charge and responsibility of the engineer," declared counsel for the engineers. He continued, "The evidence before the Board proves conclusively that all the work described as having been done by a maintainer or a fireman (helper) is work that should properly be performed by an engineer."[1]

The safety contentions were summed up in the brief:

> This Board will surely consider what might happen in the operation of the diesel-electric when the engineer is robbed part time of the two eyes and two ears of a fireman. When the fireman is in the engine room, nothing might happen for a long period of time. Everything might appear to be secure. But, there is no telling when mist, smoke or other causes might make a signal escape the eyes of the engineer, and then calamity would follow. It is singular that four major accidents during the last year happened while the fireman (helper) was in the engine room, and in each instance, that if the fireman had been in the cab, the accident might have been avoided. It is plain from the testimony that

[1] Brief of the Brotherhood of Locomotive Engineers, in: Transcript of Proceedings in so-called "Diesel Case", p. 1947.

> the horrible accident at Dickerson might have been avoided if the fireman had been in the cab. No one knows when disaster approaches, but great safeguards could be built against calamity in the operation of the world's fastest powerhouse, the diesel-electric. Two eyes, ever watchful, observant and coordinating with the engineer's, might save human lives, might prevent calamity, agony, grief and despair, might save millions of dollors of property value.[1]

So are as the diesel was concerned, the firemen were seeking two things. The 1937 National Diesel Agreement had excepted diesel locomotives weighing less than 90,000 pounds from the requirement of carrying a fireman. The Brotherhood of Locomotive Firemen and Enginemen wanted this restriction on the employment of their members removed. The second demand was for the employment of a second fireman (helper) in multiple unit operation.

The firemen contended that there should be a fireman on any locomotive operating in normal railroad service, on the road or in the yard. Said counsel for the B. L. F. and E. :

> I do not think that the rather petty method of avoiding putting a fireman on, by building yard locomotives a few hundred pounds under 90,000 pounds, weight on drivers, ought to prevail very long. If a man is needed on 90,000 pounds, he is needed on 80,500 pounds, and the railroads agreed to put a fireman on 90,000 pound locomotives. I do not think that that is really a serious subject of contention. I can hardly see how it can be seriously argued that our position is unsound.[2]

The attorney for the firemen then approached the matter of the additional man in road service. This was held to be no problem. The safety argument was advanced along the line that the total effect of the testimony of the railroads and the facts brought out

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[1]Ibid., pp. 1947-8.

[2]Brief of the Brotherhood of Locomotive Firemen and Enginemen, in _Transcript of Proceedings_ in so-called "Diesel Case", p. 1924.

in the case gave ample evidence that a fireman in the cab was essential. Standard railway practice had long recognized this need.

It was also clear, argued the firemen, that a man in the engine room was also essential. Counsel cited orders by carriers that patrolling must be done continuously by the fireman, that the fireman should come up to the cab only when called by the engineer, that the fireman should come to the cab only at certain points along the road where signal indications were so critical as to require two pairs of eyes. He held that these indicated that the railroads thought it necessary to have a man in the engine room.

Many of the roads used maintainers, taken from the shop crafts, even on single unit operation. These roads always had maintainers on diesel operation. This indicated "there is something back in the engine room that needs to be done, and that it is necessary to have somebody there, patrolling and inspecting, keeping track of what is going on." [1]

A maintainer had been called as a witness and had testified that only he and his craft were capable of doing the engine room work. Some maintainers were electricians, some were mechinists. Said counsel, "If it is a machinist, he has to learn a little electrical work; and if it is an electrician, he has to learn a little machinist work; so I judge that a little of both is sufficient, a little machinist's work, and a little electrician's work. . . ." [2]

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[1] Ibid., p. 1925.

[2] Loc. cit.,

It was pointed out that mechanics cannot make major repairs while the locomotive is operating on the road. This is not attempted. Major repairs have to be done in the shop. The maintainers went along to do what an intelligent, capable mechanic, an instructed man, or a trained man, could do.

Counsel for the firemen then argued that the firemen and the engineers were well trained and well informed about the mechanism of locomotives and their operation. They were accustomed to running repairs which could be made on steam locomotives and could easily acquire the necessary training to make any running repairs that can reasonably be made on a diesel locomotive. He cited instances in which maintainers were used for a portion of a run and relieved by firemen. Even more compelling an indication of the competence of the firemen to do the engine room job was the fact that many of the carriers did not have any maintainers at all, and would not employ them, but expected the firemen to do the job. This reduced the problem, argued the fireman, to this: "To what extent can the fireman double up and do whatever is necessary in the way of inspection, operation and repair and care in the engine room, and at the same time do his job in the cab ?"

The carriers challenged the two brotherhoods on all points. Their principal contention was that the demands for extra men on the diesels were make-work proposals; there was nothing for the extra men to do. The demands of the firemen for amendment of the 1937 National Diesel Agreement to eliminate the 90,000 pounds on drivers line of demarcation was held to be wholly unwarranted and an attempt to repudiate an agreement fairly made.

Counsel for the carriers reviewed the circumstances which had led up to the diesel agreement, and indicated that the 90,000 pounds weight had been a compromise between the two parties. Even if there had been no diesels in use at that time weighing less than this amount, the fact that the roads had insisted upon some line of demarcation should have indicated to the union that the carriers intended to make use of the line in the future. The railroads had relied upon the agreement and had installed smaller locomotives, not because of any black hearted intention to thwart the Brotherhood, but to get the lighter work done at a minimum cost. This was coupled with a conviction that firemen were not needed on the lighter locomotives. It was indicated that these locomotives were used in the type of service which never took them very far from their terminals, which gave the engineer adequate time to give the engine all the attention it needed, and which did not require the services of a second man. The carriers presented statistics indicating that on seven Western railroads in the period 1939 to 1941, diesel switchers carrying two men had had 24.57 accidents per million locomotive miles, while the one man diesel switchers had had only 18.23 accidents per million locomotive miles. It was maintained that there was no hazard involved in the operation of the smaller locomotives with only one man, that the locomotive could be efficiently operated without this additional man, that the volume of the transportation service performed by these smaller locomotives did not warrant the employment of an extra man, and that to change the 1937 rule would be unfair and unjust.[1]

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[1] Brief on Behalf of the Railroads, in: Transcript of Proceedings in so-called "Diesel Case", p. 2014.

The carriers made five main points concerning the use of additional men on road diesels: (1) The demands for additional men involved a juridictional dispute between the Brotherhoods. (2) Diesel locomotives are safely operated with present consist of engine crews. (3) Diesel locomotives have changed operating and working conditions on locomotives to such an extent there exists insufficient work to justify employment of more than two men on them. (4) Engineers and firemen are not qualified to perform any assignable additional work. (5) Any assignable additional work should be performed by an experienced machinist or electrician.[1]

To buttress their first point, the carriers reviewed the history of diesel manning negotiations and contended that the engineers had never accepted the need for a fireman on the newer form of motive power. When a fireman had been placed on Burlington diesels, the engineers had complained to the carrier that the fireman was doing engineer's work. This complaint had never been dropped. Originally the firemen had aimed merely at getting a fireman on diesel locomotives, had viewed the diesel agreement as a victory, and had shown no intention of later asking for two firemen. The engineers had wanted jurisdiction over the second man on the grounds that he was doing engineer's work, but had shown no intention of later asking for two engineers. The desire for a third man on the diesel was a comparatively recent development on the part of both labor organizations and represented really a jurisdictional dispute between them.

[1]Ibid., p. 2017.

The carriers contended that the diesel as operated was safer than the steam locomotive. The Brotherhoods had placed their reliance upon three accidents on a single railroad, the Baltimore and Ohio, and it was a matter of pure speculation in all three cases whether the fireman could have averted the accidents had he been in the cab. The counsel for the carriers pointed out that the Interstate Commerce Commission, after investigating the accidents, had made no recommendation that a fireman should be in the cab at all times. The commission is charged with safety in railroad operations and had not said that one-man operation was unsafe.

The full vision afforded the engineer was offered by the roads as the main reason for the safety record of the diesel. The position of the cab in the front of the locomotive permits the engineers a complete view of the track and signals ahead.

It was contended that the fireman had a great deal of time to spend in the cab. While requirements varied widely from road to road, studies made in actual running time, showed that firemen in all diesel passenger service spent an average of only 27.29 per cent of their time in patrolling. In freight serivce, the engineer had the benefit also of the presence of the head brakeman in the cab. This employee called signals just as did the fireman. Should the engineer require the presence of the fireman in the cab, he could summon the fireman by means of a bell which could be heard in the engine room.

The carriers also stressed the safety feature of the deadman control. It was regarded as highly improbable that the engineer should die on duty so suddenly that he would have no warning and no ability to take steps to stop his train. It was held equally improbable that in a sudden death, the engineer's body would fall on the safety pedal. It was pointed out that the fireman in the engine room has a check on the engineer by the grade crossing warning whistle blown by the engineer. The fireman could not help but notice the failure of the crossing whistle to be sounded as it makes an unpleasant and harsh sound in the engine room. This would indicate that something was wrong and the fireman would visit the cab to investigate.

The roads also pointed out that the hazards of the diesel engine crew were less than those of steam crews. In all classes of accidents in the East during the years 1936 to 1941 there was not a single engineer or fireman death in diesel service, compared to fifty-five in steam. The steam death rate was .059 per million locomotive miles. The injury rate for diesel service was .468 as against a rate of 1.142 in steam.

Concerning the changed operating and working conditions on the diesel, the carriers attempted to refute the union contentions that diesel work was more strenuous. The roads maintained that the speed of diesel operation was no greater than in steam because of the diesel's ability to operate at higher average speeds with a lower maximum speed. Evidence was also given that both engineers and firemen applied for diesel work when they were physically incapable of performing steam service work. Sixteen separate cases on ten different railroads were cited in which firemen were assigned to diesel work because they were unable to perform firemen duties on steam locomotives. These assignments had been made at the request of the employee, sometimes through the Brotherhood, and in some instances on the advice of doctors.

Testimony offered indicated that employee preference for diesel jobs was great. Some workers would lay off rather than take a steam run and often waited for the scheduling of a diesel run.

Any claim that the diesel work was more strenuous than steam was denied by the carriers. It was shown that men did not have to give up diesel work for steam in old age. Diesel enginemen did not retire as early as steam enginemen and they tended to cling to the diesel in advanced years. Three engineers in diesel service on the Burlington were over seventy years of age. Not a single steam locomotive engineer had failed to retire at age seventy. On seven Western railroads, in combined road and yard service, 27.36 per cent of all the retiring steam engineers retired before age 65. Of diesel engineers retiring, 19.64 per cent retired before 65. From January, 1936, through June, 1941, death from natural causes before retirement came to steam engineers who had an average age 2.76 years less than for diesel engineers. Diesel firemen attained an average age of 5.15 years more than steam firemen.[1]

The carriers held that firemen (helpers) and engineers were wholly unqualified for anything except the routine patrolling and checking done by the firemen and that the addition of one or more unqualified men would not further safe or efficient operation. It was maintained that neither railroad engineers nor firemen were qualified by training or experience to do the electrical and

[1] Ibid., pp. 2028-9.

mechanical work required. This work had to be done by maintainers and, in many instances, even if an additional fireman or engineer were to be assigned to the engine room, the services of a maintainer would still be required.

The engine room work was regarded by the carriers as logically neither fireman's nor engineer's work. Arguing that if the fireman's traditional place is in the cab, than all the more is the engineer's traditional place in the cab at the throttle and the controls. The engineer had always had to remain in his seat in the cab while his train was in motion. In the days of universal hand firing, the fireman often had to leave the cab to push the coal forward in the tender. Even on stoker-fired locomotives, the fireman has to leave his seat to perform many of his duties. The fireman (helper) as a person who leaves the cab had been recognized for years-- since electric locomotives were placed in service, and more particularly by the National Diesel Agreement. The assistant engineer, declared the carriers, was an unheard of person whose creation never had been nor was not then necessary.

The argument continued to the effect that the railroads' traditional and managerial right to have locomotives operated by only two men should be upheld. The carriers felt that they were the best judges of what crew was required. If they thought a maintainer or engine room employee would contribute to safe and efficient operation in a particular instance, they should have the right to select whatever craft they thought appropriate. The railroads, by virtue of history and the satisfactory experience of two-man operation of the diesel, should have the right to have the firemen who were on the trains under the terms of the National Diesel Agreement do more than just sit in the cab. Counsel for the carriers stated:

> There being no sound reason either from safety considerations or for the proper functioning of the diesel locomotive to have more men on the diesel, there is all the more reason why the traditional and managerial rights of the railroads should be respected.[1]

Finally the carriers took issue with the fears of the Brotherhoods that the diesel represented a technological innovation which would reduce the employment of their members. Mr. J. P. Shields, then Assistant Grand Chief Engineer, had testified that the B. L. E. demand for an assistant engineer was aimed in part at protecting against the loss of employment by Brotherhood members. He had indicated that the Engineers regarded the new type of power as an introduction which, in the absence of provision for assistant engineers, could reduce employment opportunities for engineers.[2] The firemen had also indicated that they feated that this technological advance in railroad operation would displace manpower.

Carriers' counsel said:

> In considering the question of employment, the condition of two individual crafts out of a great many cannot alone be controlling. ...The problem cannot be solved simply by keeping or adding men on the payroll. This would be obviously unsound for it would shoulder on the particular industry more than its fair share of social obligations. Worse yet, it would disregard the fact that the technological advance has created employment elsewhere. In the manufacture of diesels, for example, there has been extended employment of electricians and workers in other crafts who had no employment in the making of steam locomotives. The evidence clearly shows the diesel has tended to create jobs rather than destroy employment for both engineers and firemen.[3]

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[1]Ibid., p. 2032. [2]-Testimony, in: <u>Transcript of Proceedings</u> in so-called "Diesel Case", Vol. 14, pp. 488 - 9.

[3]Brief on Behalf of the Railroads, loc. cit., p. 2033.

It was further indicated that one of the impelling reasons for the adoption of the diesel had been to enable the railroads to compete for traffic which was going to buses, autos, trucks and airplanes. The improved transportation service brought about by the diesel had greatly bettered the competitive position of the railroads. The worry of the employees that the diesel would create unemployment was held to be defeatist. "This will more than likely develop if the diesel is loaded down with extra men and thus robbed of economy of operation, one of the very things that gives it stature in the competitive picture." [1]

The carriers cited the fact that many of the new passenger trains drawn by diesels had not replaced steam drawn trains but were new trains that did not before exist. Even in cases where diesel power had replaced steam power, both the engineers and the firemen received more compensation per trip in diesel service than in steam, they worked less hours, and their hourly rate was higher.

It was argued that the burden which would be imposed by either or both of the manning demands of the labor organizations would be unreasonable and weaken the competitive position of the railroads. Diesel operation would not be able to survive if it had to bear the burden of additional men to meet possible unemployment problems.[2]

The Emergency Board concluded that on multiple-unit Diesel, high-speed, main-line through passenger trains, safety of operation demanded, whenever the train was in motion, the presence of the fireman(helper) in the cab. If compliance with this finding was to

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[1]Ibid., pp. 2033-4

[2]Ibid., p. 2035.

require the services of an extra man in the engine room to perform the work customarily done by firemen, the Board concluded that such an extra man should be added.

The Board felt, however, that in multiple-unit, diesel-electric, freight road service the situation was different. The locomotive normally operated at a slower rate of speed, it hauled no passengers, and the head brakeman was in the cab and called signals when the fireman was absent. No additional man was required.

The evidence did not indicate to the Board that an extra man was needed on yard engines nor on single-unit, local freight and passenger locomotives, as requested by the engineers. Those locomotives operated at slow speeds and under comparatively simple traffic conditions, with numerous stops, which afforded the regular firemen sufficient opportunity to make inspections of the engine room.

Having concluded that under certain circumstances an extra man might be required in the operation of a diesel, the Board then had to decide whether he should be taken from the ranks of the firemen or of the engineers. The Board weighed the contentions of the two Brotherhoods as to the proper assignment of such duties and concluded that when an additional operating man was used he should be taken from the ranks of the fireman. (The Chairman disagreed with this conclusion and believed that the extra man should be an assistant engineer.)[1]

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[1] Report of Emergency Board Appointed February 20, 1943, p. 54.

The Board supported this finding with this reasoning:

> The Board believes that this decision is in keeping with the traditional demarcation between the duties of the engineer and those of the fireman. Since the early days of railroading the engine crew has consisted of an engineer, responsible for the operation of the locomotive, and a fireman who, under the jurisdiction of the engineer, has been responsible for the production of power. When not so engaged, he has assisted the engineer in the observance and calling of signals. When in the past a third man has been required, as in the hand firing of large steam locomotives, a second or assistant fireman has been used.[1]

This traditional demarcation had been buttressed by the National Diesel Agreement of 1937 and by operating rules subsequent to that time. The fireman had divided his time between the supervision of the operation of the equipment in the engine room and assisting the engineer in the calling and observing of signals. "If the duties are too extensive to permit the safe operation of high-speed passenger trains and a second helper is required, he should logically come from the ranks of the firemen."[2] This arrangement maintained the traditional relationship between the engineer and the firemen. The engineer remained in command of the operation of the locomotive and the fireman continued under his jurisdiction and general supervision.

On the other manpower proposal, that of the firemen that a member of their craft be required on all locomotives regardless of size or type of power, the Board found for the carriers. The 90,000 pounds weight on drivers limitation was held to have been a compromise. It was to be assumed that after such a settlement had

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[1] <u>Loc</u>. <u>cit</u>.

[2] Ibid., p. 55.

been reached, the carriers were free to install as many locomotives of the lesser weight as their operations appeared to them to justify. The Board found no violation of the agreement in this development.[1]

The Brotherhoods thus received through the Emergency Board proceedings very little. The Engineers were denied in their request for an assistant engineer in the engine room, and were denied jurisdiction over the engine room employees. The Firemen were to be bound by the 1937 agreement 90,000 pounds weight on drivers limitation, but did receive a finding that the fireman should remain in the cab at all times when the train was in motion in main-line passenger service. Although denied a second fireman in the engine room, any additional man used by the carriers "to perform duties customarily performed by firemen (helpers)" were to be selected from the ranks of the firemen. This last was to apply to passenger service and to freight service, but the fireman was to continue to make his patrols and inspections in freight service. It was left to the discretion of the carriers as to whether an additional man was to be employed. In the event that one would be used to perform duties customarily performed by firemen, he was to be a second fireman.

Both the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen refused to accept the findings and recommendations of the first diesel Board. Prolonged negotiations between these unions and the railroads followed. The disputes were settled only by a series of regional agreements

[1] Ibid., pp. 55-6.

known as the Diesel Settlement Agreements of 1943 and 1944. The first of these was with carriers of the Eastern region and Section 3 of this agreement, signed August 13, 1943, provided:

> On multiple-unit diesel-electric locomotives in high-speed, streamlined, or main line through passenger trains, a fireman (helper) shall be in the cab at all times when the train is in motion. If compliance with the foregoing requires the service of an additional fireman (helper) on such trains to perform the work customarily done by firemen (helpers), he shall be taken from the seniority ranks of the firemen, in which event the working conditions and rates of pay of each fireman shall be those which are specified in the firemen's schedule. The rates of pay shall be determined by the weight on drivers of the combined units.
> (Note-- The term "main line through passenger trains" includes only trains which make few or no stops).
> For the sole purpose of designating the ranks from which the employee shall be drawn and for no other purpose, it is further understood that on multiple-unit diesel-electric locomotives operated in other classes of service, should there be added a man to perform the work customarily performed by firemen (helpers) such man shall also be taken from the seniority ranks of the firemen and his working conditions and rates of pay shall be those which are specified in the Firemen's schedule. The rates of pay shall be determined by the weight on drivers of the combined units.[1]

The weight on drivers limitations of the 1937 agreement were reaffirmed and no gain accrued to the firemen as a result of the new agreement.

The terms of the Firemen's Eastern Diesel Agreement were made the basis of a similar agreement with the Western carriers on November 27, 1943, and with the carriers of the Southeastern region dated May 11, 1944.

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[1] Ibid., p. 32.

The Engineers expressed their dissatisfaction with the Board's findings by filing with the Western Carriers' Conference Committee, "A Memorandum of Exceptions Taken by the Brotherhood of Locomotive Engineers to the Recommendations of the Board", and a proposed form of contract in settlement of all pending diesel issues. This step was taken in November, 1943. Negotiations continued and a contract was formally executed between the representatives of the Brotherhood of Locomotive Engineers and the Western Carriers' Conference Committee on January 25, 1944.

Much of the new agreement was concerned with changes in the rates of pay governing steam, electric and diesel-electric locomotives. However, several sections dealt specifically with the diesel issue. Section Three of the Memorandum of Agreement read:

> In the application of this agreement it is understood that the existing duties and responsibilities of engineers will not be assigned to others. It is further understood that a second engineer is not required in multiple-unit service where the engineer operates the locomotive from one cab with one set of controls.[1]

The Brotherhood thus surrended its demand for an assistant engineer in multiple-unit operation, and received an assurance that the "existing duties and responsibilities of engineers" would not be assigned to any other craft. This last provision was to become a critical consideration in numerous disputes between the Brotherhood and the railroads.

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[1] Ibid., p. 32.

Section Six declared, "This agreement is in full settlement of the second party's proposals and the questions covering by Mediation Case A-978, and shall continue in effect, subject to change under the provisions of the Railway Labor Act as amended." [1] Case A-978 had been the Engineers' proposal acted upon by the 1943 Emergency Board.[2] There was also attached to the Engineers' Western Diesel Settlement Agreement the following memorandum:

> This will confirm our understanding that any pending claims for the employment of a second engineer in multiple-unit diesel-electric service, except those covering conditions where employees other than engineers were handling the operating controls of any of the units, are hereby withdrawn.[3]

This served to underline the fact that the Brotherhood had abandoned its efforts to obtain the assignment of an assistant engineer.

Substantially the same agreement was made with a committee representing the Eastern Carriers on December 20, 1944, and with the Southeastern Region carriers on April 3, 1945. The peace achieved under these agreements was relatively short lived.

The Engineers soon took the position that, although responsible for the safe and efficient operation of the many engine applicances in the engine room, the operating engineer was confined to the cab of the locomotive while the train was in motion.

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[1]Ibid., p. 33.

[2]Supra., pp. 58-60

[3]Cited in: Brief on Behalf of the Carriers, in: Transcript of Proceedings in Engineers' Diesel Case, p. 1192.

There was a job to be done in the engine room, particularly on multiple-unit operation, which required a well trained, highly skilled locomotive engineer back in the engine room. To the extent that the job was performed, it was done sometimes by the fireman (helper)-- whose proper and necessary place was in the locomotive cab with the engineer--and sometimes by supervisorial employees, and sometimes by members of the shop forces. This job in the engine room of the diesels stemmed directly from and partook fully of the traditional, historical, carrier imposed responsibilites and duties of the craft of locomotive engineers. Hence, the employment by the carriers of other persons to perform these duties in the engine room was in violation of the clause in the diesel agreements which provided that "the existing duties and responsibilities of engineers will not be assigned to others."

Acting on these assumptions, the Brotherhood of Locomotive Engineers served notices between March 12, 1945, and October 8, 1948, requesting the employment of an additional engineer to supervise and make road repairs and adjustments in the engine room of all diesel-electric locomotives, on 63 principal railroad and 53 subsidiaries. Under the provisions of the Railway Labor Act, these notices were processed through initial conferences with all the carriers concerned and then through mediation--first on an individual basis with some 17 railroads, and, finally, on a concerted basis with all the lines concerned. These joint sessions were held December 15-17, 1948 and January 12-14, 1949, in Chicago.

At the conclusion of the January 14th session, after the carriers had categorically rejected the Engineers' proposals and modifications, the mediators announced that further efforts at conciliation would be useless. The mediators recommended that the dispute be taken to arbitration. The next day, for the first time under the Railway Labor Act in a nationwide rule case, the Brotherhood agreed to submit the dispute to arbitration. The carriers rejected arbitration, and the National Mediation Board announced that mediation was at an end.

The Brotherhood set January 31, 1949, at 6:00 a.m. as a strike deadline and prepared to withdraw from service on 15 railroads in the West. Strike votes were processed on other roads. Before the time set for the strike, the President of the United States created an Emergency Board. The strike action was suspended, pending hearings before that Board.[1]

C. The Second Diesel Case

The Brotherhood requested the Board to rule on a six point proposal which included the revived demand for a second engineer whose duties, for the most part, were to be confined to the engine room. This additional engineer was to be employed on each multiple-unit diesel of four units or less, and on each single-unit diesel weighing 200,000 pounds or less. The second engineer was to be required in road service, and in transfer or belt-line service. This proposal was subsequently modified to exclude single-unit diesels provided that the carrier did not require any person to give attention to the engine room machinery while the locomotive was in motion. Road service was also defined more specifically

[1]A more detailed narrative may be found in the opening statement of Mr. Clifford D. O'Brien, Counsel for the Brotherhood of Locomotive Engineers, in: Ibid., Vol. 1, pp. 23-30.

subsequent to the original submission: "Road service is intended to mean that service which is assigned to road engineers as distinguished from that assigned to yard engineers as provided for in current agreements."[1]

The second point specified that the qualifications of the second engineer were to be the same as those required of engineers operating the locomotives and, in addition, of such familiarity with the engine room machinery as would qualify them to perform the duties assigned. Next, the union wanted specified that the duties of the assistant engineer were to be confined to supervision over the engine room and would consist generally of starting and stopping the diesel engines, patrolling, inspecting and giving such attention to adjustment and the operation of the engines, motors, and engine appliances as would be necessary in operation. He was not to be required to perform bench work in the units enroute or at terminals. He would make only such adjustments and light road repairs as would be necessary or practicable in road operation. The assistant, however, could be used temporarily to relieve the operating engineer enroute if and when necessary, and if permissible under operating rules.

The fourth point of the Engineers' demand specified that additional engineers should be paid at the rate of $12.97 per day for eight hours or less, while attending such instruction classes as might be required in meeting the qualifying requirements. If the assistant engineer, in the process of training and learning for

[1]Ibid., pp. 30-1.

his job in the engine room, were required to attend instruction classes at points other than the home terminal of his seniority district, he should be paid the deadhead allowance of the existing schedules, plus his actual expenses while away from his home terminal. If he were required to make road qualifying trips under instruction, he was to be paid $12.97 per 100 miles or less.

In an effort to protect the assistant engineers from any attempt of the carriers to make their lot difficult, the demands also specified that additional engineers were to go on and be relieved from duty at recognized home or far terminals for engineers.

The final point specified that, except as provided in the demands, additional engineers would be governed by the same rates, rules and working conditions as applied to the operating engineers on the same locomotives.[1]

The Brotherhood held that the 1943 Board decision and subsequent agreements based upon it had proved unequal to the realistic resolution of the issues. Both the 1943 recommendations and the diesel agreements ensuing from it had left the diesel question more confused and more complicated. The central issues, as viewed by the Engineers, involved the problem of adequate running supervision, patrol, inspection, and asjustment and repair of the machinery in the diesel engine room.[2]

The Engineers viewed the responsibilities and duties of their craft as dividing themselves into three major classifications: First was the top responsibility of the engineer for the successful

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[1]Ibid., p. 29-32.

[2]Ibid., p. 35.

and safe operation of the locomotive over the road to its terminal. Second, was the detection and prevention of trouble, and, in case of difficulties along the road, such adjustments and repair work as are practicable and necessary to complete the run into the terminal. Third, was the careful instruction of and close supervision over the fireman (termed "helpers" on other than steam power) and over his performance of his duties.[1] These responsibilities and duties, imposed by the carriers, could no longer be discharged by the engineer in his new position in the cab of the diesel-electric locomotive.

The carriers still charged the engineer with responsibility for the engine in operation (and for the helper's work on that engine) and enforced the requirements by disciplinary actions including demerits, suspensions, and discharge. The engineer was held responsible even for acting upon erroneous information concerning the condition of the engine room machinery relayed to him by the fireman, the only operating employee available under the then existing practices as a source of this information. Since the engineer had the responsibility for the engine room, an engineer should be employed there.

In support of their contentions, the Engineers advanced a three stage argument: (a) There was a job which had to be done in the engine room. (b) An additional man was needed to do the job in the engine room. (c) The additional man should be an engineer.

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[1]Ibid., p. 38.

The Brotherhood submitted very little new evidence on the first two points. In defense of their craft rights, however, the engineers called upon history and tradition. The responsibility for locomotive machinery en route had always been an important segment of the content of the craft of locomotive engineers. A clear-cut demarcation of engineers' work had developed from its early expression in operating rules, through recognition and spelling out by arbitration boards and governmental agencies. These duties and responsibilities had been carried over intact from steam service. The union maintained that the over-all responsibility imposed upon engineers had actually been increased on diesels; it was not limited merely to conditions of the engine which they could know about personally nor only to those actions of others which they could personally supervise. This was a serious distension of the engineer's responsibility. It could not adequately be discharged by the diesel engineer. That segment of the craft of locomotive engineers which held him responsible for the locomotive machinery en route between terminals required him to perform patrol, inspection, repair and adjustment, as well as to perform supervision over and to be responsible for the acts of anyone assisting him in his work.[1]

The traditional duty of the locomotive engineer to make road repairs was not altered by the fact that others assist him. Indeed, it was his responsibility to obtain the help of others, if necessary,

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[1]Brief on Behalf of Employees Represented by Brotherhood of Locomotive Engineers, in: Transcript of Proceedings in Engineers' Diesel Case, pp. 1402-1414, passim.

and to supervise them, be they other members of the train crew, track laborers, garage mechanics or members of the shop forces.[1]

The argument of the Engineers continued with the assertion that any division of the engineer's craft duties and responsibilities must be with another engineer. Any other division would seriously violate the established craft lines and creat an intolerable confusion which would complicate rather than solve the diesel question. The use of shop men, electricians or maintainers to do the work which has always been the traditional duty and final responsibility of locomotive engineers would violate the established principle that shop men do shop work in the shops. The assignment by the carriers to men of the non-operating crafts of the engine room patrol, inspection, light repair and adjustment on diesel locomotives en route was regarded by the engineers as an invasion. The shop men would certainly oppose any move by the engineers to do bench work, the major upkeep on the locomotive consisting of the heavy maintenance repair work, assembly, and disassembly done in the roundhouse and shops. Similarly, the engineers opposed any invasion of repairs en route by the shop men.

In addition to the threat to craft rights, the presence of a member of the shop crafts on the locomotive presented a problem in responsibility. The carriers imposed responsibility for the condition of the locomotive upon the engineer. Inevitably, he had been in doubt as to the functions of these shop men. In the absence of any operating rules holding him responsible for shop men

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[1]Ibid., p. 1409.

on his engine, was the engineer to exercise the same supervision over maintainers as he was required to exercise over the fireman helpers? The engineer was required by rules to see that his fireman was familiar with his duties, understood the rules, had sufficient experience, and was adequately instructed in the proper performance of his work. The maintainer, a non-operating employee, was neither familiar with the operating rules nor included in their application. He was responsible to no one under any operating rule and was apparently a free agent in an otherwise efficient scheme of train operation where responsibility of every train and engine crew member was fixed and definite.[1]

This in itself, claimed the B. L. E., made for inefficient operation. Should the maintainer have to take an engine off the line for adjustment or repair, he would not know at what point in the terrain he could safely cut out part of the power without affecting the operation of the train. He might interfere with the engineer's maintenance of a schedule or deprive the engineer of maximum power at some point on the line where it was required. The maintainer did not know and was not required to know the topography of the road, the upgrades and down-grades or the location of the scheduled stops.

The engineers also held that the use of supervisorily-titled employees to do the work presented no satisfactory solution to the problems raised by the diesel. Such a practice they felt was both demoralizing and inefficient. "What is the engineer to consider

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[1] Ibid., p. 1416.

the extent of his traditional over-all responsibility for the operation and mechanical condition of his locomotive and the action of others employed on it, if one of these others is his immediate boss?"[1]

Another attempted solution was also denied by the B. L. E. The use of firemen to handle the engine room repairs, adjustments, patrolling and inspection was regarded by the Brotherhood as a distinct violation of the craft demarcation between the work of the two crafts. Historically, the fireman, aside from his job of firing or production of power --which he does not have on diesels--has been an assistant to the engineer.

The engineer has a supervisory responsibility over the fireman, a responsibility almost impossible to fulfill with the fireman out of the cab and in the engine room. The use of a second fireman to work in the engine room would place an even larger burden of responsibility upon the engineer while making it even more difficult for him to discharge it. When the carriers attempted to get the work done by assigning it to the fireman, already assigned important duties in the cab, they were not only invading craft lines, but also interfering with the engineer's carrying out of his traditional responsibility for the entire locomotive. The practice burdened the locomotive engineer with a supervisory problem he could not discharge, consistent with the important safety requirement which binds him to the operating controls while in motion.[2]

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[1]Ibid., p. 1418.

[2]Ibid., pp. 1419-22.

The carriers had made a plea for the right of managerial discretion, holding that they should be left that degree of flexibility which would enable them to operate their railroads efficiently, economically and in the public interest. Carrier counsel had enquired whether an Emergency Board should substitute its judgment for the judgment of railroad executives charged with the responsibility of operating the railroad properties. Management should have the right to determine whether or not an additional employee was necessary to do the engine room work and what craft could best be employed at the work.[1]

The employees characterized this as a "thinly disguised attempt to fill the engine room job with employees whose rate of pay undercut the engineers' hard won pay rates and whose method of payment defeats the established mileage basis of pay. . . ."[2] Since the engineer was paid on a miles run basis, for the transportation he produced, he had a distinct and specific interest in getting his train over the road efficiently and in the shortest time consistent with speed restrictions and operating conditions. For this the engineers were paid from 13.1 cents to 14.6 cents per mile in passenger service and an average of 20.9 cents per mile in freight Pay given maintainers per mile ranged from twenty per cent to fifty per cent of the engineers' rate. These employees were paid on a monthly basis, had no specific interest in getting the train

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[1]Closing Statement on Behalf of the Carriers, in: Transcript, Vol. 21, pp. 3647-9.

[2]Brief on Behalf of Employees, in: Transcript, pp. 1422-3.

over the road in as short a time as possible, and constituted a threat to the engineers' rates of pay.[1]

The brotherhood concluded by indicating that it considered the locomotive engineer the man best qualified for this job in the engine room. The degree of mechanical knowledge of the locomotive machinery, breakdowns, and malfunctions required by the carriers of their engineers particularly qualified that craft for the inspection, patrolling, adjustment, and light repair duties. The B. L. E. further declared that it was and had been fully willing to cooperate with any carrier program for giving additional training to or raising the qualifications of diesel engineers.

The carriers disagreed on all counts. They indicated flatly that there was no need for the services of an additional man on diesel locomotives. Such a man would render no useful service in connection with the operation of diesel power, was not required by safety considerations, and the cost of an additional engineer would be out of all proportion to the value of his services.

Statistics were presented dealing with diesel operations on the Burlington Lines indicating that an additional man would have had an opportunity possibly to prevent an engine failure or shorten a delay on an average of only once each 750 trips during the years 1947 and 1948. Over that period the wages which would have been paid an assistant engineer amounted to $4,596.04 for each diesel delay without regard for whether or not the presence of an assistant could have prevented the delay.[2]

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[1]Ibid., pp. 1423-4.

[2]Transcript, p. 2743.

Carrier testimony pointed out that from November 11, 1934, to December 16, 1935, the first four diesel trains of the Burlington were operated by one man, no fireman was employed either in the cab or in the engine room. During this time, the trains made 1752 trips, not a single passenger or employee was injured, they reached their final terminals under their own power on 99.7 per cent of the trips, they ran an average of 26,164 miles (261 days of engineer pay) per each mechanical delay, and they ran 120,357 miles per each failure requiring assistance to reach the final terminal.[1] This performance, argued the carriers, indicated that so great was the reliability of the diesel that two men were not required to operate it--to say nothing of more than two.

With two man operation in 1948, the Burlington's diesels averaged 28,000 miles for each mechanical delay. The Seaboard Airline Railroad with passenger diesels in the same year averaged 42,512 miles per failure or delay. In freight service, the average was 12,986 miles.[2] Such trouble-free operation served to indicate that there was no job in the engine room.

Mr. James M. Symes, vice president in charge of operations of the Pennsylvania Railroad testified that the Pennsylvanis considered terminal maintenance to be entirely adequate for efficient operations:

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[1]Testimony of Mr. Ralph Budd, President, Chicago, Burlington & Quincy Railroad, in: <u>Transcript</u>, pp. 2206-11

[2]Testimony of Mr. C. H. Sauls, General Manager, Seaboard Airline Railroad, in: <u>Transcript</u>, p. 2279.

> Experience has indicated to us that repairs can be better made at regular maintenance points, with engines standing still, where we are equipped with the necessary tools and materials and have available highly skilled mechanics, than is possible by 'tinkering' with adjustments and controls by less experienced help with locomotives moving at high rates of speed.[1]

Testimony was also offered that very few of the roads used maintainers. One of the Carriers' Exhibits said in summary:

> 1) The use of supervisors and other employees selected from the mechanics class to ride diesel locomotives, either part or full time, is decreasing instead of increasing.
> 2) Where such employees are assigned, they are for the purpose of performing shop work; for which others than mechanics are not qualified to do this work.
> 3) The use of Road Foremen and other supervisors is decreasing instead of increasing, when we see that there are 6-1/2 times as many diesel road locomotives as there were in 1943.
> 4) The work performed by Road Foreman and other road supervisors is entirely foreign to the duties and responsibilities claimed for a second engineer.[2]

In a less direct portion of their argument the carriers maintained that in and by the diesel settlement agreements of 1943 and 1944, the Brotherhood of Locomotive Engineers had contracted away and waived all rights to demand the assignment of an engineer to the engine rooms of diesel locomotives. Section III of those agreements was at issue: "In the application of this agreement it is understood that the existing duties and responsibilities of

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[1]Transcript, pp. 2361-2.

[2]Carriers' Exhibit No. 17. Cited in: Brief on Behalf of the Carriers, in <u>Transcript</u>, p. 1239.

engineers will not be assigned to others. It is further understood that a second engineer is not required in multiple-unit service where the engineer operates the locomotive from one cab with one set of controls."[1]

The Brotherhood had indicated in its testimony that the first sentence of Section Three was designed to preserve to the engineer the right to perform in the engine room those duties consistent with his overall responsibility for the locomotive. The question of diesel engine room supervision, road repairs, and adjustments, was said to be dealt with solely by the first sentence. The second sentence, as interpreted by the Engineers, dealt with matters separate and apart from, and unconnected with the first sentence. The second sentence related only to the assignment of and additional operating engineer; it was not concerned with the question of engine room supervision, and adjustment and repairs.[2]

This interpretation was denied by the carriers. They held that any such construction was in conflict with the representations made by the B. L. E. at the time the agreements were made and also with the plain and literal meaning of the language of the Section. At the time the agreements were made, the "existing" duties of the engineers included no engine room duties. The firemen had taken engine room duties under the findings of the 1943 Emergency Board and subsequent agreements between the Brotherhood of Locomotive Firemen and Enginemen and the carriers. The "existing"

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[1]Supra., pp. 74-6.

[2]Transcript, pp. 484, 563-72 passim.

duties and responsibilities of the engineers had not changed. The carriers held that these "then as now, while the train was in motion, included only (1) the manipulation of the operating controls and, (2) general supervision and jurisdiction of the locomotive."[1]

The engineers had never given attention to the machinery in diesel engine rooms while the train was in motion. The very nature of their duties in operating locomotives made it impossible for them to leave the operating controls. Had the Brotherhood intended to secure an exclusive right to engine room work the language of Section Three would have been vastly different. The carriers further indicated that the language of Section Three had been that of the Brotherhood accepted by the carriers.

Counsel for the carriers declared that two inferences were possible. Either the language of the first sentence did not mean at the time the agreements were signed what the Brotherhood now said that it meant, or the BLE had tricked the carriers into accepting language which would subject them to then unsuspected penalties. "In either event the employees should not be allowed to succeed in their contentions."[2]

The Board held for the carriers. The issue, as seen by the Board, did not relate to all the duties and responsibilities of the engineer, but only to the duties and responsibilities of the craft as respected engine room operation on the diesel-electric locomotive while the train is enroute.

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[1]Brief on Behalf of the Carriers, in: <u>Transcript</u>, p. 1277.

[2]<u>Ibid</u>., p. 1280

Said the Board:

> The narrow issue before us is whether or not preservation of the established craft rights of engineers supports the B.L.E. claim for an additional engineer who shall be made solely responsible for the engine room while the train is enroute and who shall either perform or supervise the engine room work. Is approval of this proposition essential to the preservation of essential craft rights of engineers?[1]

The Board's consideration of the fundamental issue in the case and of the various basic questions raised by the Brotherhood contentions was on five main bases. First, they examined the carrier rules, operating practices, and policies applied in discipline cases in an effort to determine whether or not the craft rights claimed by the engineers were traditionally performed by them or required of them by the carriers. The Board found that the traditional and long established responsibilities could not be said to give the engineers a right actually to perform or directly to supervise all engine room work. "This right cannot be sought by analogy with steam operations--the analogy argues against the engineers."[2] After examining the problem of engineer responsibilities and duties in some detail the Board concluded:

> It must, accordingly, be seen that application of carrier imposed rules, practices, and policies does not, and may not, give foundation to the demand here made. Under such rules, practices, and policies, the B.L.E. cannot properly exercise a craft claim over engine room work of diesel-electrics on the ground that such work has traditionally been performed by them and traditionally expected of them

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[1]<u>Report</u> of Emergency Board Appointed January 28, 1949, p. 27, in <u>Transcript</u>, pp. 1505-91.

[2]<u>Ibid</u>., p. 34

> by the carriers on all locomotives, including diesel-electrics.[1]

Secondly, the Board reviewed the early development of the diesel question in an attempt to determine whether or not the engineers uninterruptedly achieved or pursued a claim to the traditional craft rights, as stated by them, in the operation of diesel-electric locomotives. The Brotherhood had maintained that it had consistently, from the very first use of diesel power, claimed the craft rights it was claiming in the proceeding before the Board. Historically, the Board found, the duties claimed by the engineers had been assigned to the fireman--from the first employment of a fireman (helper) on diesels. The first demand of the engineers for an additional member of their craft had been on the grounds that the firemen were not qualified to do the engine room work. The carriers had objected to this request on the grounds that three men, engineer, fireman, and maintainer, were already employed on diesels. The Brotherhood had then explained that their request was predicated on the assumption that it was possible, desirable and entirely practicable to qualify engineers to assume the duties then being discharged by the electricians. The claim to this work was not urged as necessary to preserve engineers' traditional duties, but upon the premise that the work was such that engineers could, in time, qualify to preform it--thus supplanting the electricians then being used. The Board regarded it as significant that the electricians were not represented by any organization at the time this demand for the work being done

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[1] *Ibid.*, p. 38.

by them was made.[1] The engineers had not protested the assignment of engine room duties to the firemen, nor had the B.L.E. urged the employment of a second engineer on any basis save safety and efficiency until comparatively recently. In summary of its findings on this point the Board said:

> The implication of the record of early attempts to deal with the diesel question scarcely needs comment. It suffices to say that the work in diesel engine rooms now claimed by the B.L.E. is not shown to be traditionally that of engineers, nor has it been continuously claimed as such by the organization.[2]

The third consideration of the Board was an analysis of the B.L.E. agreements with the Western, Eastern and Southeastern Carriers' Conferences in 1943 and 1944 to determine whether or not the claim of the organization to engine room work was preserved or abandoned and intended so to be in those agreements. The consideration again hinged upon Section Three of the agreements. The contentions of the B.L.E. that that section had been one of the means by which they had continued and preserved their craft rights was reviewed. The Board felt that it had the duty to make a finding of fact on the question whether that contention was correct or whether by that section or other provisions of those B.L.E. agreements with the carriers, the Brotherhood had voluntarily relinquished by contract any claim to those craft rights or any claim to have an additional engineer assigned to the engine room of diesels regardless of a craft-right basis. Whether the

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[1]*Ibid.*, p. 41.

[2]Ibid., pp. 44-5.

organization had actually intended to relinquish any such claims by those contracts, even though the contracts might not have achieved that purpose, became of major importance in any appraisal of the equity to the union's demand. The Emergency Board admitted that it was not an arbitration tribunal but viewed a finding on the issue to be within its powers and necessary to its function. It had to try to ascertain what the parties reasonably or actually intended to accomplish by their agreement in order to pass judgment upon the equity of the demand. After an extensive analysis of the problem, the Board concluded that the B.L.E. had, in Section Three, "contracted away, clearly intended to contract away, any claim, regardless of the basis of the claims, for a second or assistant engineer to do work of any kind whatsoever in the engine room of diesel-electric locomotives while in motion."[1]

The Board then turned to a consideration of the B.L.E. claim that the employment of an additional engineer in the engine room had merit, apart from traditional craft rights, upon the grounds that it would contribute to the safe and efficient operation of the locomotive. The Board pointed out that no argument had been made by the engineers that they must do the work themselves in order to contribute to the end of increased efficiency and safety of operation. They were quite willing that firemen or others do the work provided only that an engineer directly supervise the man who actually performed the labor.

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[1]The Board considered this problem at length in its Report from p. 46 through p. 74. The specific conclusion is found in: Ibid., p. 74.

The alternatives proposed by the Brotherhood were either the closing of the engine room so as to prevent any attention en route, or the assignment of an assistant engineer either to perform such work or to supervise its performance. The discontinuance of any attention to the engine room would scarcely contribute to increased efficiency or safety, in the Board's opinion. Testimony had indicated that the engineers were not competent to perform the work, so that their assignment to it would not contribute to either efficiency or safety. This left only the matter of supervision.

The Board noted that the engineer did supervise the fireman who did whatever patrolling was done while the train was in motion. Employment of an additional engineer would only provide direct supervision under the eye, not of the existing engineer, but of another engineer. This assistant engineer would carry out his responsibilities quite independently of the present engineer. The traditional duty of the operating engineer for general supervision of the engine from draw bar to draw bar would be completely ended. In its place, entire divided responsibilities and powers would be introduced. Said the Board:

> Just how this divided responsibility would work to improve the service was never spelled out for the Board by the engineers. Would the present fireman be subject to two engineer bosses while the train is in motion? If so, which of the two would have the superior authority over him? What would be the relationship between the two engineers in meeting problems affecting both of their exclusive spheres? Instead of contributing to efficiency of operation, such a system as proposed by the engineers would seem to create confusion and diminish, rather than increase, efficiency.[1]

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[1] *Ibid.*, p. 76.

The Board could find "absolutely nothing in the record on which to base a recommendation that the employment of a full-time engineer to watch patrol, inspection, adjustment and light repairing by firemen, or work done by the maintainer, in the engine room of diesels would increase efficiency of operation sufficiently to justify his employment."[1] No safety considerations important enough to justify an additional engineer were admitted.

The *Report* of the Emergency Board, dated April 11, 1949, thus denied any justification for acceptance of the Brotherhood of Locomotive Enginners' claims for the employment of an additional engineer in multiple unit diesel operations. The same personnel, George W. Taylor (Chairman), Grady Lewis, and George E. Osborne, also heard, as an Emergency Board appointed February 15, 1949, yet another "diesel case" brought by the Brotherhood of Locomotive Firemen and Enginemen.

D. The Third Diesel Case

The so-called "Firemen's Diesel Case" arose out of notices dated June 30, 1947, served by the B.L.F. and E. upon 160 railroads, and three notices of the same date served by the Western, Eastern, and Southeastern Carriers on the union. The notices served by the Brotherhood had for their purpose the alteration of the three existing regional agreements between the union and the carrier groups entered into in 1943 and 1944. Six issues were raised by the Firemen, but only two of these related to the diesel and will be considered here.

On December 22, 1947, request was made by the Brotherhood for a national conference on the issues. Because of the inauguration of a wage-rules movement which was not finally settled until No-

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[1]*Ibid.*, pp. 76-7.

vember 12, 1948, no further action was taken upon the issues until November 20, 1948. The Firemen then officially informed the carriers that conferences between carrier and employee representatives had been held and no agreement reached. On January 14, 1949, the national groups met. The carriers suggested progressing the case into mediation immediately, in order to expedite the proceeding. The B.L.F. and E. stated its opposition to any procedure which would result in a repetition of the 1943 situation in which the Firemen case and the Brotherhood of Locomotive Engineers case were heard before the one Emergency Board. The carriers then declined to make any changes in the existing agreements, and the parties jointly invoked the services of the National Mediation Board, on January 15, 1949. The Brotherhood accepted an offer of arbitration, but the carriers declined. On February 15, 1949, without any strike vote having been taken by the Brotherhood, the Emergency Board was created.

The issues involving the diesel were: (1) Shall an additional fireman (helper) be assigned on all diesel-electric locomotives operated in road service for each four units or less? And (2) Shall a fireman be assigned to locomotives operating in yard service and weighing 90,000 pounds or less on drivers?

Existing agreements provided that the fireman should be in the cab of multiple unit diesel locomotives in high speed streamlined, or main line through passenger trains at all times when the train was in motion. The agreements further provided that if compliance with the above required the service of an additional man on such trains to perform the work customarily done by firemen, he was to be taken from the seniority ranks of the firemen. Locomotives weighing under 90,000 pounds on the drivers were not required to carry a fireman.

The Board noted that the issue raised by the proposal of the Brotherhood for the employment of an additional fireman (helper) on all road diesel-electric locomotives was by far the most important of the issues before it. Not only did this issue involve a substantial proposed addition to the wage bill of the industry (the carriers had estimated that the assignment of a second fireman on road diesels would increase the total annual wage bill of Class I railroads by more than 40 million dollars[1]), but it had an important bearing upon what the relative operating effectiveness of diesels in comparison with steam and other types of locomotives would be. Other road locomotives would be operated with a crew of two. The larger crew on the diesel might provide more jobs for firemen, but it would also entail an offset of an increased wage cost against the proved operating advantages--against the productivity--of diesels and would substantially cut down the extent of the technological advantages which had been widely attributed to the new type power.

The Board, therefore, considered the critical additional fireman issue in some detail. The agreements providing that in high-speed, main line, multiunit passenger trains the fire man should be in the cab at all times when the train was in motion had compensating carrier rules. These required that the train would be

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[1]Transcript of Proceedings of the Emergency Board in Firemen's Diesel Case (Washington: Ward and Paul, 1949) p. 2133.

stopped, if necessary, to enable the fireman to give attention to engine room machinery en route. Except for those roads which employed maintainers, the engine rooms in this high-speed service were not given patrolling attention while the train was in motion. The fireman could inspect the machinery at the infrequent station stops and do a limited amount of work then if necessary.

The Brotherhood claimed, however, that this rule had proved unsatisfactory in practice. In reality, ran the union's argument, the fireman was expected to perform engine room work while the train was in motion and the rule requiring him to watch signals was accordingly frequently violated in order to maintain schedules. It was also claimed that unscheduled stops to enable the fireman to attend to the engine room increased greatly the chance of rear-end collisions. The Firemen contended that when the fireman had to remain in the cab, others, in violation of his rights, performed his "customary work" in the engine room. The only way out, said the Brotherhood, was to assign an additional fireman to these locomotives.[1]

The organization also claimed that the existing operating methods in freight service were equally unsatisfactory. The safety aspects involved in having someone in addition to the engineer in the cab were stressed by the Fireman as was their contention that this person must be a fireman rather than a head brakeman who, on most roads either because of rule requirements or established practice, rides in the cab. He is normally available to watch signals.

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[1] Report of Emergency Board Appointed February 15, 1949, p. 20, in Transcript of Proceedings in Firemen's Diesel Case, pp. 2115-2249.

during such times as the fireman is absent in the engine room. The Brotherhood maintained that the regular duties of the head-end brakeman prevented him from properly performing the lookout functions of the fireman. In addition, the fireman, rather than the brakeman is the person best fitted by training and experience to act as lookout assistant to the engineer. Also, contended the B.L.F. and E. the brakeman watching signals takes over "customary duties" of the fireman to which the fireman craft is entitled. Again the Brotherhood concluded that the only way out was to employ an additional fireman.

In general the main line of the Brotherhood's argument on the safety and efficiency of operations aspects of the situation followed the same lines as it had in the 1943 proceeding. It ran as follows: (a) Considerations of safety required the presence of a fireman in the cab of all road diesels at all times; (b) there was also essential work in the engine room that must be done by a fireman; (c) it followed that a second fireman was required to perform the engine room work; (d) the greater producitivity of the diesels, as compared to steam, had enabled the carriers to effect substantial savings through adopting the diesel but only at the expense of some firemen whose job opportunities had decreased or been eliminated; (e) under these circumstances, firemen displaced as a result of the introduction of diesel power should be employed in other new jobs created by the diesel.[1]

The Board considered the point about increased productivity and

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[1] "Brief for the Brotherhood of Locomotive Fireman and Enginemen," pp. 42-3. In: Transcript of Proceedings in Firemens' Diesel Case, pp. 1961-2114.

the contention based upon possible technological unemployment as subsidiary. Their validity depended upon the validity of the preceding steps in the argument as the Board did not think that the Brotherhood would ask for an additional fireman if there was no useful job for him to perform.[1]

The Board was of the opinion that these questions had been dealt with by the 1943 Board and was inclined to reject the organization contention that the case presented a new problem. This contention was based upon the increase in dieselization over the intervening years, particularly in freight service. On a percentage basis the number of diesels used in yard switching service had declined considerably with the "diesel problem" becoming more one concerned with road operations. The Brotherhood had stated:

> It is in freight service today that the need for the protection proposed by the Brotherhood is greatest and the impact on the man is greatest. It is the widespread and intensive use of multiple-unit diesels in high-speed, heavy-tonnage, through-freight movements that today spearheads the diesel problem, distinguishes it from the 1943 problem, and that makes it one of the most serious problems encountered by railroad enginemen since the inception of this industry.[2]

Said the Board in reply:

> A more extensive present use of diesel-electrics than in 1943 is, in itself, no compelling reason for concluding that operating rules, negotiated when a lesser number of diesels was in use, are necessarily inequitable to the firemen or inevitably inadequate for safe and efficient operation. To be sure, the assignment of more firemen to diesels has doubtless resulted in more widespread interest in the way these locomotives are run and in more intensive scrutiny of the rules. Adequacy

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[1] Report, p. 43.

[2] Brief for the Brotherhood, pp. 38-9.

> or inadequacy of the operating rules has to be appraised, however, in terms of how they work out in practice and not on the basis of how widely applicable they are.[1]

The Board admitted that the growth in dieselized freight service did raise some problems as to whether the experience with freight operation had been, in 1943, sufficient to enable the parties to establish sound, workable rules for freight operations on a fully informed basis. In its consideration of freight operations, the Board took note of the fact that the general practice was for the fireman to patrol the engine room, answer alarms, and do whatever work was necessary in the engine room while en route. The use of maintainers was the exception rather than the rule and was of little or no importance for the railroads as a whole.

The parties had been in substantial disagreement as to the amount of time spent by the fireman in the engine room and, therefore out of the cab. The organization had claimed that the amount of time varied according to the variety of factors, and averaged from a third to one-half of the time en route.[2] Time studies made by the carriers on 12 of the largest users of diesels in such service indicated that the fireman was absent from the cab while the train was in motion only about 14 per cent of the time.[3]

Another factor which the Board felt had to be considered in the freight service aspects was the number and longer time of stops

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[1] Report, pp. 44-5.

[2] Brief for the Brotherhood, pp. 48-51.

[3] Report, p. 67.

which may be and had to be made. The lack of pressure to meet set schedules, in contrast to passenger service, provided greater opportunity to patrol and do other work in the engine room while the train was not in motion. There had been no showing that under these practices the operation had not been satisfactory or that, in addition to the time spent by the fireman, it would be necessary to assign an additional fireman to the engine room.

The Firemen had advanced as an argument for breaking the cab and engine room portions of the job in two that the existing rules placed an undue burden upon the fireman in having to decide which of two possibly conflicting duties he would perform. The Board did not feel that this constituted an "undue burden":

> It is quite true that some of the fireman's job is to be performed in the cab and some of it in the engine room and that he cannot do both at the same time. But no rules demand such an impossibility. The fireman, along with every other employee, always has had a variety of duties which could not all be performed simultaneously and which require both a knowledge of operating rules and some exercise of judgment in choosing the one applicable to the situation at the time.[1]

While no justifiable claim for an additional fireman could be recognized by the Board under existing operating practice, this practice had been made possible because there was no rule requiring the fireman to remain in the cab at all times. The Brotherhood request would extend the watching rule to all road diesels used in freight service and would create there the same problems as existed in high-speed passenger service. However,

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[1] *Ibid.*, p. 68.

noted the Board, the requested rule went well beyond the watching rule in force on main-line passenger trains. The rule there applied only to the time the train was in motion. The requested rule would make it mandatory for the fireman to stay in the cab <u>at all times</u>. Such a rule in freight service where there are frequent and long stops, at which time there was no need for his presence in the cab, regardless of whether the brakeman was there, and was or was not qualified to observe and call signals and do other lookout duties, would require that the fireman remain in the cab. Such a rule would effectively prevent the fireman from patrolling even at stops in freight service. This would have a serious effect upon existing practice.

The fastest scheduled freight trains only seldom or in a few instances exceeded an average speed for running time of 40 miles per hour. The speeds of the trains powered by steam were about the same as those of diesels with the two types of power often used interchangeably on some runs and making the same schedules. The Board considered such actual running speeds as well as the authorized maximum speeds as far below those in passenger service.[1]

The Board argued that even if speed were, per se, a factor in safety, that factor would not be present in freight service to any appreciable degree. Certainly it would not exist to an extent sufficient to compel the fireman to remain in the cab even while the train was in motion. It would provide absolutely no reason for his presence while the train was standing still. In the opinion of the Board:

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[1] <u>Ibid</u>., pp. 70-1.

> The demand which would extend in freight service the watching rule beyond its present applicability to high-speed passenger service is completely indefensible and entirely unjustified on grounds of safety or any other valid reason.[1]

In addition, in the Board's opinion, the safety record of diesel-electric locomotives used in freight service under the existing operating rules and practices disclosed no need for any change in them so far as manpower was concerned. In support of its position, the tribunal cited the comparative accident rates of the two types of power. In the three-year period from 1946 to 1949 in freight service on 23 representative railroads there had been 73 trainmen on duty killed and 535 injured in steam service by reason of train accidents as against 3 killed and 59 injured in diesel powered trains. In terms of casualty rate per million locomotive-miles, there were 0.06 killed and 0.41 injured in steam as against 0.02 killed and 0.32 injured in diesel operations.[2] The Board noted further that only a small percentage of the accidents that did occur had any relationship whatsoever to the presence or absence of a fireman or head end brakeman in the cab.

Granting only for purposes of argument that some additional person should be in the cab at least while the train was in motion, the Board considered whether it was essential that this other person be a fireman. Would the need be satisfied if the head-end brakeman were in the cab when the fireman was not? The Brotherhood had contended that this would not satisfy the safety requirements.[3]

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[1]*Ibid.*, p. 71.

[2]Carriers' Exhibit 22, Tables 18, 20.

[3]*Transcript*, pp. 2169-2176.

The union had urged that the duty of the head brakeman to look backward to observe the condition of the train prevented his being an effective lookout forward. This the Board held to be not valid. If it were, it would similarly disqualify both the fireman and the engineer, for the duty to look back was common to all three. The fact that it was the primary duty of the head brakeman did not constitute a sufficient difference upon which to ground a distinction. In addition, the observation of the train, which could be done only on curves, never presented making sufficient observation forward on slow-moving freight trains.[1]

The Board considered the head brakeman as well qualified to perform the watching duties as the fireman. He received the same training and instructions and passed the same operating examinations as firemen. The duty to observe and call signals and perform the other functions of a lookout, regardless of the presence of the fireman, had existed for decades. On hand-fired steam locomotives, he had to do most of the watching as the fireman had to be on the deck of the locomotive cab much of the time shoveling.

It was conceded that the brakeman was not so well qualified as the fireman to take over the mechanical operation of the locomotive in the case of death or illness of the engineer, no such ability seemed necessary to the Board. The only essential was that he know how to stop the train and the simplicity of that operation was such that it could be performed by any member of the crew. The fireman, if he were in the engine room, could be called to take charge

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[1]<u>Report</u>, p. 74.

after the train had been halted.[1]

The Brotherhood had argued that on some railroads it was standard for the head brakeman to ride in the cab of the trailing unit and was not in the operating cab with the engineer. The Board felt that this was the only argument that raised any real question. It took into consideration, however, that on most roads it was either the rule or practice that the brakeman be in the operating cab whenever the fireman was absent, and that the two roads which had no such rule or practice were willing to institute it if it were held necessary or advisable. The Board did not feel that the fact that some few railroads did not make provision for the brakeman to be in the cab in the absence of the fireman was sufficient to force all roads to require a fireman to be in the cab at all times while the train was in motion, much less to adopt the more drastic rule that would require him to be there at all times en route, even while the train was standing safely for long periods of time.[2]

On these various grounds the Board concluded that no valid reason existed as to either through-freight service or local-freight service for adopting the B.L.F. and E. proposal that a fireman be assigned to the cab of diesel-powered freight trains at all times.

In its consideration of the Brotherhood's demand for the more rigid watching rule (requiring a fireman in the cab at all times) in multi-unit, high-speed, main-line passenger trains, the Board

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[1] *Ibid.*, pp. 74-6.

[2] *Ibid.*, p. 80.

went over more familiar ground. In this service, existing rules required the fireman in the cab while the train was in motion. In consequence, in this service and only in this service, any engine room work done en route was performed either by the fireman at the regularly schedules but infrequent station stops, at unscheduled stops made for the purpose of permitting the fireman to give necessary attention to the engine room, or by maintainers, spot checkers, or variously titled service or supervisory personnel.

However, the Brotherhood contended that the watching rule was being consistently violated because of the pressure of schedules, and the danger involved in unscheduled stops. In addition, it was claimed, the assignment of engine room work to others infringed upon the work of firemen. Therefore, an additional fireman assigned to the engine room was necessary.

The Board viewed itself as being required to answer three questions:

> (1) To further safe operations, should the present watching rule be modified so as to require the fireman to remain in the cab at all times?
> (2) If the present watching rule is either so modified or continued as at present, does compliance with the watching rule depend upon the assignment of an additional fireman to perform engine room work en route?
> (3) Do the firemen have an exclusive right to perform engine room work en route which is violated by assigning such work to others?[1]

The Brotherhood had contended that violation of the rule was inevitable and the Board conceded that violations had occurred. Violations had been more prevalent on some roads than on others and

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[1]*Ibid.*, p. 81.

carriers in general had been acting in good faith to secure compliance with the rule. Some had issued special bulletins admonishing train crews to obey the rule; some had posted bulletins to the same effect in the cabs of diesels.

The "on-time" tradition blamed by the B.L.F. and E. for many of the violations was held by the Board to be countered by another tradition that took precedence--safety. The rule had been recommended by the 1943 Board with a view to contributing to the safety of operations. The present Board felt that although a duty rested upon the employees to conform to any operating rule, it seemed that an added desire might well be expected of them in carrying out any safety measure adopted for their own protection as well as for the protection of the train. Said the Board: "This is especially so since they now urge safety of operation as a principal cause to support present demands."[1]

The carriers, while admitting violations, suggested that these may not actually have resulted in unsafe conditions. In their view, the rule was unnecessarily restrictive and inflexible. However, they did their best to enforce it as it was part of a labor agreement. The roads advanced different reasons for whatever violations occurred. In contrast to the Brotherhoods position the carrier view of the matter was that the engine crews sometimes decided on its own initiative that at slow speeds or under particularly favorable road conditions, the fireman could safely leave the cab. The men themselves decide, therefore, contended the roads, that the

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[1] Ibid., p. 82.

watching rule is too inflexible to be practical and they violate it. The carriers argued, and with reason, that it ill became the Brotherhood to seek to use violations by firemen of any agreement term under which the carriers were able and willing to operate as a reason for adding an additional fireman.[1]

The Board took the position that if the rule were observed, safety would be adequately provided for as a lookout, admitted by the Brotherhood to be adequate, would always be in the cab when the train was in motion. The Board said further:

> We know of nothing, and no evidence on the point was submitted to us, to show that the fireman might contribute to the safety of the train by being restricted to the cab while the train is standing.[2]

If the firemen were to persist in going back to the engine room while the train was in motion, and if the rule proved to be no more enforceable in the future than it had in the past, the Board considered it proper that it should examine the hazard of such conduct in the light of past performance. Evidence submitted by both parties had indicated that with the existing rule rigidly enforced, or with it more or less casually disregarded, the matter of safety of operation from the head of the train presented no problem. Safety had been demonstrated.

Since the rule was apparently regarded as too inflexible and impractical by both the employees and the carriers, the Board suggested that negotiations between them on the subject might at least be considered as one way of arriving at a possible answer to

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[1]"Brief on Behalf of the Carriers," p. 117. In: Transcript of Proceedings in Firemens' Diesel Case, pp. 1775-1959.

[2]Report, p. 83.

the problems of getting a safe, workable, and efficient watching rule.[1] With this gratuitous counsel, the Board moved on to the safety problems involved in unscheduled stops.

The Brotherhood had asserted that unscheduled stops to enable the fireman to quit the cab to attend an alarm in the engine room were impractical as well as unsafe. Reasoning that such stops were necessary in the enforcement of the existing watching rule, the practice of stopping trains at unscheduled points along the line of the road was dangerous in any case, said the Firemen, and especially dangerous on the main trunk lines with their density of traffic where the high-speed passenger trains operated. Need for such stops could be eliminated, it was claimed, only by hiring an additional fireman for engine room duties. The safety insured thereby would justify the hiring, according to the Brotherhood view.[2]

In refutation of this point the carriers had cited delay statistics in both steam and diesel service.[3] Diesel locomotives had lost 1.1 per cent in hours over a six months' period because of road delays while steam power in the same time had lost 13.2 per cent. The Board accepted the carrier contention that unscheduled stops to permit the fireman to answer engine room alarms were not a frequent necessity or occurrence. Nor could the Board admit that the few stops which did occur should be classed as hazardous. An examination of the accident statistics had revealed the occurrence of no

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[1] Ibid., p. 84.

[2] "Brief on Behalf of the Brotherhood," pp. 64-6.

[3] Transcript, pp. 3716-3722.

rear-end collisions as a result of the stopping rule.[1]

The Board also denied the organization contention that the unscheduled stop rule was impractical because stops frequently could not be made in time to prevent engine room damage or because grades or curves precluded stopping. It was felt that these were indeed remote contingencies. Since unscheduled stops with diesels were few compared to steam, the stop problem could not be regarded as acute. In summary, the Board held:

> The infrequency of unscheduled stops with their accompanying lack of accidents or damages, coupled with the reported rigid enforcement by carriers of the rear-end flagging rule, working in conjunction with the automatic train stops which are in use as required by the Safety Bureau of the Interstate Commerce Commission, all combine to render the hazard of the unscheduled-stop rule entirely negligible. The contention certainly does not in any way indicate the need for an extra fireman either to diminish unscheduled stops or to eliminate them in whole.[2]

Concerning the claim of the Brotherhood of Locomotive Firemen and Enginemen to an exclusive right to engine-room work, the Board declared that such work had traditionally been assigned to others in addition to firemen. No strict line of demarcation had ever been drawn between engine room work to be performed by the firemen and work to be done by others.

The lack of any exclusive right of firemen to engine room work had been tacit in the report of the 1943 diesel Board. The 1949 Board reviewed the 1943 findings and pointed out that its predecessor had remarked upon the fact that employees other than

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[1] Report, p. 85.

[2] Ibid., pp. 85-6.

firemen sometimes not only did maintenance and repair work but also engaged in work of an operational character. The Board had suggested that harmonious relationship between the parties could best be maintained by such other employees not performing operational duties. This suggestion had not been accepted.

It was also noted that the use of maintainers in the engine rooms of diesel locomotives had declined as the carriers had learned from experience that such attention was not necessary. If the Brotherhood felt that this now far from prevalent use of other crafts in the engine rooms constituted a violation of labor agreements with the carriers, it had access through defined channels to the Railway Adjustment Board. The Board noted that no such claims had been processed and very few had been filed with the carriers.[1] This indicated that violations were few.

Those other than firemen who were assigned to the engine room were doing no more than they had always done and which the carriers had every right to assign to them. Employees who were given only intermittent, spot-checking assignments could not be performing regular and periodic patrol. Said the Board:

> There are no valid reasons to support the demand of the B.L.F. and E for assignement of an additional fireman to the engine rooms of high-speed passenger trains on the ground that firemen have an exclusive right to perform all or some of the work done in the engine room en route.[2]

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[1]*Report*, p. 88.

[2]*Ibid.*, p. 89.

The Board thus denied the Firemen an additional member of their craft both in freight service and in high-speed passenger service. It also considered several other classes of service. The watching rule requiring the presence of the fireman in the cab at all times while the train is in motion did not apply to single-unit, streamlined trains. These were characterizied by relatively high average speeds for short distances between frequent station stops. Such schedules were made possible by the acceleration characteristics of the diesel-electric locomotive, but the use of only one unit dictated that such trains be short and light.

In this class service it was permitted that the fireman make patrol inspection trips, leaving the cab, while the train was in motion. The need for patrolling en route was much reduced by the frequent station stops, and the existence of only one engine room reduced the time thus spent to a minimum. The quite limited duties of the fireman in this service reduced the consideration of need for an additional fireman to a question of safety. Again the Board indicated that the safety and efficiency records of the diesel foreclosed any possible need for an additional fireman in this class of service.[1]

The class of service designated by the industry as "conventional passenger service" employed standard passenger cars powered by diesel locomotives. The locomotive might be either single or a multiunit plant, depending upon the requirements of the particular train. Because of the relatively greater weight of the conventional

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[1] _Ibid._, pp. 90-2.

cars compared with the light-weight, streamlined cars, such trains were more sluggish and operated normally on slower schedules than did the high-speed, streamline trains. These conventional trains marked the transitional period of changing from the older type of trains, formerly powered by steam locomotives, to the newer type, made up of streamlined cars and diesel locomotives. The Board felt, however, that this class of train had contributed its proportionate part to the accomplishments of diesels generally and was included in all statistical computations affecting safety of operation, as well as dependability and reliability. No justification could be seen for adding an additional fireman in this class of service.[1]

A comparatively new development in the diesel field, the so-called "road switcher" which had no engine room but a hooded engine, but which could be and was used in multi-unit operation both in freight and passenger service had been included in the organization's demand. No additional fireman was requested on single unit hooded engines.

Need for an additional fireman (helper) on this class of power was claimed upon the ground that the fireman could not attend a trailing unit should anything go wrong with its motor. Being hooded, no repairs could be made while the locomotive was in motion, and the sole function of a fireman in the event of trouble would be to stop the motor. This would serve only the safety and protection of the machinery.

The carriers had indicated that no more than a limited inspection

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[1] *Ibid.*, p. 92.

as to the condition and supply of lubricating oil and the battery-charging indicators was necessary and this was performed only when the train was standing. Safety regulations of the ICC required a catwalk between the units provided with a hand-rail and a steel hand-rail guarded passageway along the trailing unit. Carrier rules required that no employee move from unit to unit while the train was in motion. Since in most examples of multiunit, hooded locomotive operation, all of the motors could be stopped from the operating cab, the Board could see no need for an additional fireman in freight service employing such motive power.[1]

The Brotherhood had indicated that if such power were used in passenger service, the heating unit for the train might be located on the trailing unit. This normally would require servicing and periodic attention from the fireman. However, no evidence on this score had been presented to the Board and it concluded:

> Thus, it is clear that the very reason relied upon for an additional fireman is nonexistent in every case where the facts were submitted to the Board. Furthermore, no instance is shown of damage to the trailing unit by lack of an additional fireman, nor is a case of a cold passenger presented that the attention of an additional fireman to a heating unit in the second locomotive would have prevented or alleviated. In any case, such situations would properly address themselves to management as problems for solution rather than to the brotherhood for organizational handling . . . . . The demand has no merit.[2]

The Board thus concluded that the Brotherhood claims arising out of the request for a change in contracts to provide for the em-

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[1]*Ibid.*, p. 94

[2]*Ibid.*, p. 95.

ployment of an additional fireman on road diesels should not be recommended, but should be denied in all respects.

The B.L.F. and E. proposal to eliminate the 90,000 pound exception to the definition of what constituted a "locomotive" to which a fireman or helper had to be assigned was also examined by the Board. The 90,000 pound figure had been fixed by agreement between the Brotherhood and the carriers. The organization now sought to have this line of demarcation removed. It repeated its contentions from the earlier case: at the time of the agreement no such light motive power was in use and it had not expected that any would be introduced, operation--even within yard limits--with only one man in the cab was not safe, the number of such units was small and the assignment of a fireman to them would not represent a major item of expense.

The Board found against the organization on all counts. It held that the additional wages for such employees would total over a million dollars annually.[1] It was convinced that no good safety reason existed for altering the existing practice and that no increased efficiency sufficient to justify compelling the assignment of a fireman to these small switchers had been shown.[2]

On the score of safety, the Board had little concern. The engineer on such switchers was required by rule to stop whenever he could not see a member of the ground crew who could relay signals to him. This rule was held sufficient to insure safe operation and accident statistics indicated no necessity for a change. The Board's

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[1]Brief on Behalf of the Carriers, p. 65.

[2]*Report*, p. 99.

conclusion from all the evidence was that there was no reason for eliminating the 90,000 exception which referred to the assignment of firemen on locomotives operating in yard service.[1]

The concern of both the engine service brotherhoods over the impact of the diesel locomotive upon their crafts has thus been manifest to the extent of three separate Emergency Board proceedings. In the 1943 case the presentations of both organizations had been joined before the Board. In that instance, only the Firemen had received any relief from what they regarded as a threat. The recommendations of the tribunal and subsequent agreements with the carriers were to the effect that the fireman must remain in the cab in high-speed, main-line passenger service. If any additional employee were to be placed in the engine room to do the work customarily assigned to the fireman, such an employee should be taken from the seniority ranks of the firemen.

The Engineers had been denied completely in their demand for the assignment of an additional engineer to the engine rooms in multiunit diesel operation both in the 1943 and in the 1949 proceedings. The Firemen came out of their 1949 proceeding with no more than they had the 1943 proceeding.

The continuing interest of the organizations in the "diesel question" serves as an indication of the importance they accord it. It cannot be denied that the bulk of their concern springs from the fear of displacement. It would seem that the arguments advanced by the Brotherhoods and rejected by the several Emergency Boards were rationalizations, attempts to win through reason an end dictated

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[1] _Ibid._, p. 102.

by what they felt was necessity. The issue of technological unemployment was not squarely faced by either the organizations or the Boards in any of the cases.

The only statement really pertinent to the technological displacement question was made by the Board in the 1949 Firemen proceeding. In a footnote to its Report the Board said:

> It is not shown in the evidence before us that any significant technological unemployment has resulted from dieselization. Elimination of some helper service, made possible by substitution of diesel for steam, has also eliminated some helper jobs in some districts. The capacity of diesels to haul more cars and heavier tonnage indicates that fewer firemen are needed to handle a given volume of freight. These two tendencies are emphasized by the Brotherhood. On the other hand, the total number of firemen needed depends primarily upon the total volume of freight to be handled and the total volume of passenger travel. If diesels provide a needed means of placing the railroads in a competitive position, they may be responsible for a greater volume of traffic than would be forthcoming without dieselization. Dieselization has unquestionably improved the competitive position of the railroads and may very well prove to be a program providing for greater job security instead of employee displacement. It may bring about what might be termed technological employment.[1]

This rather common view of innovation deserves to be examined in more detail than that permitted the Board. The fear of the labor organizations has not arisen in a vacuum. The writings and speeches of their leaders testify to the fact that the fear is a real one and one felt acutely by the membership. Isolated instances of

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[1]Ibid., p. 43, n.

severe displacement have been cited by both organizations, but it has not yet appeared definite whether such instances are merely a continuation of the stream of increased productivity arising from more powerful motive power or represent the result of a true technological innovation in the railroad industry.[1]

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[1] Almost any issue of the monthly magazines of either of the Brotherhoods has a paragraph or two devoted to this subject. In general the data is most obscure, consisting only of a report that "the jobs of twenty men" have been "wiped out" by dieselization on some unspecified division of some unspecified railroad.

IV DISPLACEMENT EFFECTS OF THE DIESEL UPON FIREMEN AND ENGINEERS

The firemen and the engineers have expressed the most concern with the introduction and spread of the diesel-electric locomotive. These are the crafts most intimately connected with railroad motive power and it is inescapeable that employees have acquired, in the process of learning their craft, a vested interest in the mechanism through which their trade was carried on.

The fireman has felt himself most threatened by the innovation. His functions have changed markedly. This is the culmination of an atrophy which began with the introduction of automatic stokers on coal burning locomotives. Only the duties of the fireman concerned with the operation of the train have not changed. Even in this area, however, the patrolling and inspection duties in the engine room in all but high-speed passenger service, take him out of the cab. The absence of the fireman from the operating cab cannot help but detract to a degree from the operating content of his job. His engine room duties, in the main, are of a limited and routine nature. The highly specialized skills involved in maintaining an adequate fire and an adequate supply of steam for the efficient operation of the steam locomotive are no longer required of him.

It is no exaggeration to say that the fireman has retained a job of its present status, in all probability, only because of the efforts of his Brotherhood on his behalf. The carriers recognized the compulsion induced by the threat of strike. Since firemen were a necessity on steam locomotives, the gradual and incomplete dieselization did not permit the roads to join the issue. The precedent offered by the retention of a fireman (helper) on electric locomotives also was a point in aid of the firemen. The roads accepted the presence of a fireman on the diesel-electric locomotive in road service.

Acceptance, however, does not necessarily constitute an effective demand for firemen. The effect of the new motive power upon the demand for and the employment of firemen is difficult to measure. As was noted above, a representative of the carriers stated categorically in 1943, "It cannot be said the diesel has brought on any new technological unemployment problem."[1] This requires, however, an agreement as to the meaning of the word "new". The Brotherhoods have concerned themselves greatly with the displacement aspects[2] and have cited them in the various Emergency Board proceedings. In any event, the job content of the fireman's craft has been decreased by the introduction of the diesel.

As was indicated in Chapter I, the diesel characteristics coupled with electric traction enable the diesel to pull longer

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[1]Testimony of F. G. Gurley, in: Transcript, so-called "Diesel Case," Vol. 7, p. 1805.

[2]Numerous articles and editorials have appeared in the pages of the Brotherhood of Locomotive Firemen and Enginemen's Magazine and in the Brotherhood of Locomotive Engineers Journal. See particularly, "Enginemen Bear Brunt of Attack as New Policies Develop with Diezelization," Magazine, Vol. 129, No. 6, December 1950, and Vol. 130, No. 1, January, 1951.

and heaver trains at a higher average speed. This ability is less important in passenger service than in freight service and, despite the wide-spread use of diesel power in passenger service, the demand for both firemen and engineers is less determined by the power of the locomotive than by a variety of other factors.

In passenger service, the level of business depends in part on how often people undertake journeys and in part upon how far they go. Business conditions can affect the amount of travel by influencing either the number or the length of trips. For example, railroad travel has fluctuated in rough harmony with the general distrubances in the rest of the economy and each phase in passenger travel. A few months after the business contraction of 1920-21 began, travel started to decline. This continued for some time thereafter. During the long business expansion from 1933 to 1937, passenger traffic rose to a peak in October, 1934, then declined somewhat, later rising to a final peak in March, 1937.[1] During the war years passenger traffic in America soared to new heights far above any registered in the past.

Not content with being acted upon by business conditions, passenger traffic is also affected by movements in the general population. The marked tendency toward suburban living which developed during the 1920's was reflected in a larger number of commuters or potential commuters. The populations of almost all commuting areas increased greatly under this influence toward suburban living and the percentage of all passenger traffic represented by commuter travel rose

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[1]Thor Hultgren, op. cit., pp. 43-56.

in turn. In the public works expansion which occurred after 1933, many highway improvements calculated to facilitate the flow of motor traffic in metropolitan regions were undertaken. These enhanced the relative attractiveness of driving to work and made possible better bus service. The result was less commutation traffic. The continuing improvement of highways in the vicinity of the larger cities has reinforced this trend.

In addition to these factors, the level of passenger traffic is also acted upon by the season of the year, the unseasonality of the weather, an epidemic, or any number of random factors which can affect the volume of passenger beyond the limits of price elasticity. The railway, however, by its very nature as a common carrier is required to offer adequate service, regardless of the effective demand for that service.

The demand for crews in passenger service is a function of the number of trains run. This has no constant dependence upon the numbers of passengers to be carried.

TABLE VIII

INDICES OF PASSENGER TRAIN-MILES AND PASSENGER MILES WITH TOTAL TIME PAID ROAD PASSENGER ENGINEERS AND FIREMEN*
(1940=100)

Year	Passenger Train-Miles	Passenger Miles	Time Paid Engineers	Time Paid Firemen
1940	100.0	100.0	100.0	100.0
1941	103.6	123.2	103.8	104.8
1942	112.1	225.7	114.8	118.5
1943	123.1	369.8	125.8	131.1
1944	127.0	403.2	133.2	140.1
1945	129.1	385.0	136.9	144.2
1946	120.0	272.2	126.5	132.8
1947	110.2	192.8	117.2	121.6
1948	108.2	172.2	115.0	118.8

*SOURCE: Statistics of Railways, Tables 55B, 44 and 69. (Computed)

Table VIII indicates the highly volatile nature of passenger traffic, particularly during the years of World War II. It will be noted that although passenger miles travelled had a range from the low of 100.0 in 1940 to a high of 403.2 in index number terms, the miles travelled by passenger trains varied only between 100.0 and 129.1. Comparison of this latter measure with the indices of total time paid either engineers or firemen shows that employment varies more closely with train miles than with passenger miles. This, of course, reflects a more intensive loading of passenger trains during war time, each train in general carried more passengers further than in more normal times.

It will be also noted from the Table that time paid engine service employees varied more widely than did the milage of the trains upon which they were employed. This reflects an increase in overtime payments. The index of hours paid for the firemen ran consistently higher than did the index for engineers over this period. This reflects, in part, thepromotion of firemen to the post of engineer, thereby reducing the amount of overtime paid members of that craft, while creating a comparative shortage of experienced firemen necessitating the payment of more overtime to that work.

In any event, the variation in time paid was considerably less than the variation in passenger miles. Despite the growth of diezelization in passenger service over the period, the index of time paid firemen in 1948 was 0.3 points higher than in 1942 although passenger train miles were 3.9 points lower in the latter year. Evidence of displacement cannot be deduced from this source.

TABLE IX

MONTHLY INDICES OF PASSENGER TRAIN-MILES, PASSENGER MILES, TOTAL TIME PAID ROAD PASSENGER ENGINEERS AND FIREMEN, AND PER CENT OF DIESELIZATION 1949-1951*
(January 1949=100)

Year	Month	Per Cent Train-Miles Diesel Powered	Pass. Train-Miles	Pass. Miles	Time Paid Engineers	Time Paid Firemen
1949	Jan.	37.5%	100.0	100.0	100.0	100.0
	Feb.	38.4	87.5	79.4	87.6	87.2
	Mar.	39.6	95.9	79.4	94.4	93.8
	Apr.	42.2	93.5	82.4	91.0	90.2
	May	44.1	94.2	79.4	91.4	90.1
	Jun.	44.7	92.4	91.2	91.4	90.2
	Jul.	45.3	95.5	100.0	100.7	99.6
	Aug.	45.4	94.5	97.0	99.6	99.5
	Sep.	46.3	88.5	85.3	90.8	89.6
	Oct.	48.1	87.8	73.5	87.8	86.6
	Nov.	50.5	84.2	73.5	83.2	82.7
	Dec.	46.9	95.0	85.3	93.4	93.4
1950	Jan.	51.2	87.5	79.4	87.8	85.9
	Feb.	56.6	73.0	64.6	73.3	71.6
	Mar.	54.4	85.5	67.6	84.7	83.8
	Apr.	52.6	86.4	70.6	84.5	83.8
	May	53.2	84.2	64.6	84.8	82.8
	Jun.	52.6	87.2	83.2	90.4	89.3
	Jul.	53.3	90.0	88.3	96.0	94.7
	Aug.	53.8	93.0	91.2	97.9	96.8
	Sep.	54.0	88.5	82.3	89.5	88.2
	Oct.	55.0	89.8	76.5	89.1	88.0
	Nov.	55.4	86.8	73.6	85.4	85.7
	Dec.	53.2	95.2	91.2	94.5	95.9
1951	Jan.	54.6	93.4	88.3	92.3	91.6
	Feb.	56.1	79.4	70.6	80.6	79.7
	Mar.	56.5	90.7	79.4	86.5	83.8
	Apr.	58.4	86.2	76.5	84.4	84.0
	May	6011	87.5	76.5	87.5	86.2
	Jun.	60.4	85.5	91.2	88.0	87.0
	Jul.	60.6	87.8	94.0	95.3	94.3
	Aug.	61.4	88.7	97.1	94.4	93.8
	Sep.	63.2	84.2	85.3	85.0	84.3
	Oct.	64.6	85.8	79.4	85.4	84.3
	Nov.	64.3	83.9	79.4	82.3	82.3
	Dec.	62.1	92.0	100.0	92.0	92.9

*SOURCE: "Wage Statistics of Class I Steam Railways." (Computed)

The wide variations characteristic of passenger traffic are also shown in Table IX where the index of passenger miles varies from 100.0 to 64.6. Passenger train miles, however, has a range only from 100.0 to 73.0 and the variation in total time paid firemen and engineers more closely approximates this latter figure, to 71.6 for firemen and to 73.3 for engineers. Each of these low points was reached in February of 1950 and the low in passenger miles was repeated in May of the same year.

No significant change in the relationship between the index for passenger train miles and the indices of employment can be found over this three year period, although the degree of dieselization increased greatly. The index of total time paid firemen and helpers was above the index of passenger train miles in 13 of the 36 months, three months in 1949, four months in 1950, and six months in 1951. It is difficult to read into this any displacement of firemen by the increase in diesel operation.

The index of time paid engineers exhibited a similar relationship with the index of passenger train miles. Four months in 1949, seven in 1950, and five in 1951 saw the index of time paid higher than the index of passenger train miles. A comparison of the two indices gives no indication that the position of the engineers has declined as a result of the increase in dieselization.

When the indices of time paid engine service employees and passenger miles are compared, again it is difficult to see any weakening in the position of the employees. The index of time paid firemen was above the index of passenger miles in 29 of the 36 months, and that for engineers was higher in 31 of the months. It is true that the 1951 movements of the indices resulted in four months in which the index of passenger miles was above that for time paid firemen and for time paid engineers. These were the months of June, August, September, and December. In each of these months an increase in passenger travel failed to call forth an equivalent rise in time paid engine crews. This reflected an increase in the intensity of use of train facilities as no corresponding increase in passenger train miles occurred. If this may be viewed as an increase in the productivity of the engine crews, similarly it was an increase in the productivity of the passenger train equipment.

The effect of the adoption of diesel locomotives, which in themselves can do but little to vary the number of train miles operated in passenger service, upon the payment of firemen and engineers has been slight indeed. The diesel has exercised its greatest influence upon passenger train operation in the form of speed increases, but the dual method of payment in effect for train service employees has protected the workers from any detrimental effects from this source. It would thus appear that a smaller demand for firemen and engineers based merely on the speed characteristics of the diesel is unlikely.

The diesel locomotive can and does operate over many divisions in the course of a normal run and the same crew could operate it at present speeds over several divisions before the time allowance would be consumed and time and one half have to be paid. However, seniority lists are normally kept on a divisional basis and the consolidation of two or more divisions for operating purposes poses problems in this connection which inhibit such action on the part of the carriers. Payment on a mileage basis is no greater to one crew than to three or four different crews, but the complications offered by seniority rules effectively prevent any severe reduction in the number of crews in order to take full advantage of the distance characteristics of the diesel.

The employment of firemen and engineers has, thus, been little affected by the speed and the distance abilities of the new motive power. However, the tractive effort characteristics which enable the diesel locomotive to draw more weight than steam locomotives present a slightly different problem.

The ability of the diesel-electric locomotive to pull more weight has eliminated the use of helper locomotives for some passenger and freight service. So far as passenger service be concerned, this has not been a significant development. The amount of helper territory for passenger trains has not been great in the past. The elimination of helper service, even in freight, because of the greater tractive power of the diesel has progressed and may be expected to continue.

It is doubtful, however, that helper service will be completely abandoned even if the diesel completely replaces the steam locomotive. It would not be economic for a carrier to employ for all of a long distance run a locomotive with sufficient power to take its train over a really severe grade. What would be just enough power over that ruling grade would be excess power over most of the run. It is true that some of the excess could be converted into additional speed in flatter country, but again practical operating considerations stand in the way of speed above a certain limit. It appears that some helper territory will be retained for operating reasons, although the greater power of the diesel permits a reduction.

The displacement of helper service employees is an inevitable concomitant of the spreading use of the diesel. This displacement, however severe in itself to the personnel concerned, is not particularly significant for the overall scene. In 1934, when the diesel was a comparatively small factor in an overall consideration of motive power, helper locomotive miles were 6.1 per cent of total locomotive miles in freight service and 2.0 per cent in passenger service. In 1949, these percentages were 5.3 per cent in freight and 1.3 per cent in passenger service.[1] Even the complete abandonment of this service would not result in severe displacement of engine service employees.

The impact of helper service displacement bears more heavily upon the shop crafts. The elimination of round houses and servicing facilities at helper locations is made possible as helper territory is eliminated. However, maintenance installations for helper service were never extensive and the relationship between the number of locomotives to be serviced and the labor requirements for that servicing were not proportional, particularly in the lower grades of labor.

It is in freight service that the principal effects of the tractive effort characteristics of the diesel are felt by the concerned engine service employees. The carriers can, in the absence of the compulsion to keep regular schedules present in passenger service, take advantage of the superior ability of the diesel to draw heavy loads and bring a heavy train up to operating speed in a short time. The practice noted above that is followed by some carriers of running freight trains on

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[1]Statistics of Railways (1934, 1949), Table 54.

an extra basis and not dispatching a freight train until the weight is up to the limitations of the locomotive has served to reduce the number of trains necessary to transport a given quantity of freight. Heavier trains mean fewer trains and fewer train crews. It is in this area that the Brotherhoods now recognize the principle threat of the diesel to their craft.

As was noted in Chapter III, the "diesel problem" had evolved over the years from a concern only with yard and passenger service to become primarily a problem in freight service. The use of diesel power in freight service did not pass the experimental stage until 1941 but within ten years over half of the freight train miles were run behind diesel power. The advantages of the new power in freight service rapidly became manifest to the railroads. During the war years, government regulations prevented the introduction of diesels in passenger service, unless on mail trains, and channeled the available new diesels into freight service. The volume of freight traffic nearly doubled in the war years but no such rise in freight train miles or in employment resulted. This, again, reflected the more intensive utilization of available equipment.

TABLE X

INDICES OF FREIGHT TRAIN-MILES AND REVENUE TON MILES WITH TOTAL TIME PAID ROAD-FREIGHT FIREMEN IN THROUGH AND IN LOCAL AND WAY FREIGHT SERVICE, 1940-48*

(1940 = 100)

Year	Freight Train-Miles	Revenue Ton-Miles	Time Paid Firemen Through	Local	Total
1940	100.0	100.0	100.0	100.0	100.0
1941	107.8	127.2	125.1	113.7	121.0
1942	138.1	171.0	162.2	125.6	148.9
1943	145.2	194.7	180.3	128.2	161.6
1944	144.5	197.5	183.4	133.1	164.8
1945	134.6	182.3	171.5	132.0	157.1
1946	122.1	158.6	146.2	128.9	140.0
1947	127.4	175.1	153.0	132.4	143.2
1948	125.0	171.1	137.4	132.1	135.8

* SOURCE: Statistics of Railways, Tables 55A, 44, and 69. (Computed)

It may be seen from Table X that the war years with their great increase in traffic called forth a great increase in time paid to firemen engaged in through freight service. Although this increase in hours paid did not keep pace with the rise in the revenue ton-miles, it more than kept pace with the rise in train miles. The nature of the freight movement is also obvious from the table. Time paid through freight service firemen rose far more than did the time paid firemen engaged in local and way service. The return to a more normal pattern of freight movements in and after 1946 is shown by the relative rise in the index of time paid local and way freight firemen.

From Table X it can be seen that the employment of firemen in freight service tends to vary more nearly directly with the volume of traffic than is the case with passenger service. It will also be noted that the firemen engaged in local and way freight service have had more stable employment than have those in through freight service. This, in addition to reflecting the nature of the war time freight, also reflects the fact that local and way freight service is commonly offered, within limits, regardless of the volume of traffic. It also appears that the employment of local and way firemen has not declined in proportion to the volume of freight traffic to the extent that the through freight firemen have been affected. This, again, may be a reflection more of the changing nature of freight traffic than of motive power developments, but this conclusion is a doubtful one.

The diesel locomotives, for the most part, have been introduced into the longer and heavier through freight runs. The more modern locomotives which they have replaced have been demoted to through runs of less critical importance,[1] the marginal steam power thus replaced, in many instances, has been applied to local and way freight runs. It is still the older and less powerful and efficient motive power that is used in local service and the effects of the diesel have not yet reached local service to the same extent that through runs have been affected. The introduction, since the war, of the so-called "road-switcher" has permitted the dieselization of many local services which would have had to wait for many years for a more expensive diesel locomotive.

No evidence of displacement of freight firemen through the increase in dieselization can be noted over the period 1940 to 1948. The employment of freight engineers follows the same general pattern as that of firemen and the same conditions may be noted in that occupation, as well.

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[1] Annual Report of Erie Railroad Company, 1945, pp. 9-10.

TABLE XI

INDICES OF FREIGHT TRAIN-MILES, REVENUE TON-MILES, AND TOTAL TIME PAID ROAD-FREIGHT FIREMEN AND ENGINEERS, WITH PER CENT OF TRAIN MILES WITH DIESEL POWER BY MONTHS, 1949-1951*
(January, 1949 = 100)

Year	Month	Freight Train Miles	Per Cent Diesel	Revenue Ton Miles	All Freight Engineers	All Freight Firemen
1949	Jan.	100.0	23.1	100.0	100.0	100.0
	Feb.	91.3	23.9	92.5	89.3	90.4
	Mar.	96.4	26.4	95.6	90.6	91.3
	Apr.	94.5	26.7	102.0	90.3	90.6
	May	96.7	27.6	104.1	93.6	94.0
	June	91.8	29.0	97.6	91.2	91.3
	July	90.0	30.9	88.6	92.2	92.1
	Aug.	90.2	31.1	96.0	95.6	96.0
	Sept.	86.6	32.1	90.7	85.6	86.0
	Oct.	86.7	34.4	83.1	82.1	82.8
	Nov.	90.2	34.2	94.2	85.3	86.2
	Dec.	91.7	35.0	93.2	87.5	88.8
1950	Jan.	87.8	37.0	85.1	83.9	84.4
	Feb.	75.8	41.4	74.4	71.6	72.6
	Mar.	94.4	38.0	104.0	90.6	91.7
	Apr.	93.2	38.2	101.5	88.1	88.8
	May	94.8	38.2	105.0	92.3	92.5
	June	94.8	38.5	106.2	96.5	96.1
	July	95.4	39.5	106.2	98.8	87.5
	Aug.	103.3	38.8	122.7	107.4	106.6
	Sept.	101.0	39.1	119.0	101.2	100.8
	Oct.	107.2	39.5	127.8	105.8	118.1
	Nov.	99.8	41.2	113.3	97.7	98.0
	Dec.	100.0	42.5	112.0	99.6	99.9
1951	Jan.	102.8	43.1	116.8	100.8	101.0
	Feb.	87.6	43.5	99.6	86.8	87.3
	Mar.	105.4	44.4	121.7	104.2	104.0
	Apr.	99.9	46.4	117.2	93.6	94.0
	May	100.8	48.7	121.7	96.8	96.6
	June	118.3	40.7	116.8	96.1	95.9
	July	93.5	51.3	110.0	96.6	95.3
	Aug.	100.3	50.4	124.3	102.0	101.1
	Sept.	96.3	52.0	120.0	93.7	93.0
	Oct.	102.0	52.4	128.8	99.8	99.5
	Nov.	97.6	54.1	117.8	92.9	92.9
	Dec.	95.3	55.2	109.0	92.0	92.1

*SOURCE: "Freight Train Performance," M-211; "Revenue Traffic Statistics," M-220; "Wage Statistics of Class I Steam Railways," M-300, Bureau of Transport Economics and Statistics, ICC. (Computed).

TABLE XII

INDICES OF FREIGHT TRAIN-MILES, REVENUE TON-MILES, AND TOTAL TIME PAID THROUGH FREIGHT FIREMEN AND LOCAL AND WAY FREIGHT FIREMEN, WITH PER CENT OF TRAIN-MILES BY DIESEL POWER BY MONTHS, 1949-1951*
(January, 1949 = 100)

Year	Month	Freight Train Miles	Per Cent Diesel	Revenue Ton Miles	Through Freight Firemen	Local Freight Firemen
1949	Jan.	100.0	23.1	100.0	100.0	100.0
	Feb.	91.3	23.9	92.5	89.5	90.6
	Mar.	96.4	26.4	95.6	88.7	95.6
	Apr.	94.5	26.7	102.0	88.3	94.3
	May	96.7	27.6	104.1	92.5	96.3
	June	91.8	29.0	97.6	88.3	96.0
	July	90.0	30.9	88.6	89.7	96.0
	Aug.	90.2	31.1	96.0	92.5	101.5
	Sept.	86.6	32.1	90.7	82.6	91.5
	Oct.	86.7	34.4	83.1	77.7	90.2
	Nov.	90.2	34.2	94.2	81.7	93.5
	Dec.	91.7	35.0	93.2	85.6	92.4
1950	Jan.	87.8	37.0	85.1	81.7	89.0
	Feb.	75.8	41.4	74.4	69.0	78.0
	Mar.	94.4	38.0	104.0	88.7	96.5
	Apr.	93.2	38.2	101.5	86.6	92.0
	May	94.8	38.2	105.0	89.7	96.6
	June	94.8	38.5	106.2	94.2	99.0
	July	95.4	39.5	106.2	96.5	99.0
	Aug.	103.3	38.8	122.7	105.2	108.9
	Sept.	101.0	39.1	119.0	99.5	103.3
	Oct.	107.2	39.5	127.8	123.1	109.0
	Nov.	99.8	41.2	113.3	95.5	102.2
	Dec.	100.0	42.5	112.0	99.5	100.8
1951	Jan.	102.8	43.1	116.8	99.4	103.9
	Feb.	87.6	43.5	99.6	85.4	90.4
	Mar.	105.4	44.4	121.7	102.8	108.7
	Apr.	99.9	46.4	117.2	92.6	95.7
	May	100.8	48.7	121.7	94.0	100.8
	June	118.3	40.7	116.8	93.0	100.1
	July	93.5	51.3	110.0	92.7	99.5
	Aug.	100.3	50.4	124.3	97.5	106.9
	Sept.	96.3	52.0	120.0	87.4	98.2
	Oct.	102.0	52.4	128.8	94.0	108.8
	Nov.	97.6	54.1	117.8	89.0	99.0
	Dec.	95.3	55.2	109.0	90.2	95.1

*SOURCE: "Freight Train Performance," M-211; "Revenue Traffic Statistics" M-220; "Wage Statistics of Class I Steam Railways," M-300, Bureau of Transport Economics and Statistics, ICC. (Computed).

From Table XI it may be noted that the time paid freight engine service employees varies, as in passenger service, more nearly as train-miles, rather than with the ton-miles. This is, again, an indication of greater utilization of the transportation facilities and a reflection of the flexibility of the industry.

However, no indication can be noted over this three year period of any decrease in engine service employment as a result of the increase in dieselization. Over this period the per cent of train miles drawn by diesel power more than doubled, but the relationships between the indices did not change appreciably. It is true that at the end of the period the indices of employment lagged behind the index of ton-miles to a greater extent than earlier in the period, but this again is normal for the industry and has been the usual relationship in the past as traffic has increased.

Certainly, no conclusive evidence can be deduced from the relationships between traffic and employment which would indicate any severe displacement of engineers or firemen.

A comparison between employment in through freight and in local and way freight is made in Table XII. Here, too, many of the same relationships can be seen between the level of traffic, train miles, and employment. Again, no indication of displacement can be noted which is severe enough to lead to a conclusion that the dieselization of freight service has been responsible. The historical relationships noted in Chapter II between traffic and employment have not been breached over these years, despite the fact that the per cent of dieselization rose from 23.1 per cent to 55.6 per cent. The indices must be examined over the entire period, however, or it is possible to arrive at false conclusions. For example, in May of 1951, the index of train miles stood at 100.8, while the index of hours paid all freight firemen stood at 96.6. Upon first inspection this would appear to represent a clear loss in employment of 4.2 points from the relationship existing in January of 1949. However, when the indices for both through freight firemen and local and way firemen are examined in this connection it is seen that the index for local freight firemen stood at 100.8 and the entire deficit was in the through freight component of the total, as that index was 94.0. Comparison of May with August, 1951, shows the index of train miles at 100.3 and the index for all firemen at 101.1 - no loss. Again, an examination of the figures for local firemen shows the August index at 106.9, clearly no loss. However, the index for time paid through firemen stood at 97.5, well above the May level, although below the train-mile index and the total firemen index.

It thus appears that the relationships are not entirely constant but vary with the nature of the traffic. It is obvious, however, that no consistent trend to indicate an employment loss to the firemen exists. On the basis of a very small difference, it could be argued that the through freight engine service employees have lost ground to an extent not felt by the local freight service employees. However, this cannot be demonstrated as an examination of the indices for December, 1950, indicates that with the train miles index standing at 100.0, the index for through firemen was at 99.5 and the index for local firemen at 100.8. Any change over 24 months, during which the per cent of dieselization rose from 23.1 per cent to 42.5 per cent, is insignificant. The index for ton-miles in that month was 112.0. This could indicate a note worthy increase in productivity, both of employees and of equipment. However, the relationships in December, 1950, differ little from those in effect in April, 1949. In the earlier month, the ton-miles index was 102.0, the index of time paid all firemen was only 90.6, that for the through firemen only 88.3, and for local firemen, 94.3. The increase in dieselization from the 26.7 per cent of April, 1949, to the 42.5 per cent of December 1949, did not result in a significant loss in employment.

It is difficult on the basis of any statistical evidence to ascribe to the diesel the responsibility for any severe displacement of engineers or firemen. It is true that dieselization is not complete and is still in the process of increasing. But, with well over half of the train miles being operated with diesel power, any great effect would have begun to be visible. This is not the case.

A comparison between railroads using the diesel extensively and those using it not at all or less extensively yields no consistent picture which can be taken as evidence of displacement. In a random sample of twenty of the nation's Class I carriers there was no statistically significant relationship between the extent of dieselization and the employment of engine service workers. The expected results in fuel costs, water costs, and materials could be noted but no causal relationship in the area of labor costs exists.

For this portion of the study, twenty carriers were chosen using a table of random numbers applied to the numbering given the railroads in <u>Statistics of Railways</u>, 1949. The per cent of total train miles powered by diesel on each road was plotted against an item of expense per traffic unit computed from the expense accounts of the railway as reported to the ICC.

The resulting scatter diagrams revealed no visible relation between the degree of dieselization and maintenance costs per traffic unit, total labor cost per traffic unit, or payment to the various engine and train service crafts per traffic unit. In no area of labor cost per traffic unit was the computed coefficient of correlation statistically significant. The validity of the sample was demonstrated in part by significant relationships between the degree of dieselization and fuel and water costs per traffic unit. This portion of the study constitutes only weak negative evidence and, hence, is not reported in detail.

Examinations over time and between carriers have thus failed to yield evidence of displacement through dieselization. This is not to say that in certain instances there has not been displacement. In helper service, on some branch lines, and in some crafts, the diesel has eliminated jobs and employment. On the national scene, however, this has not been the case and the classical tradition of the results of technological innovation appears to have been maintained.

Other train service employees, such as conductors, trainmen, etc., vary in employment much as do the engineers and firemen. A train needs a conductor and a number of brakemen just as certainly as it needs an engineer and a fireman. The same forces operate with those employees as with the engine service employees and the same inconclusive or negative results may be noted.

It is possible that further increases in dieselization may result in some significant displacement. The nature of the traffic to be moved and the hauls required by it will exercise a greater effect upon the employment called forth by that traffic than will the nature of the motive power used to transport it. The complete elimination of helper service would displace perhaps six per cent of the engine service employees. The abandonment of now unprofitable branch lines maintained only because of regulatory compulsion to maintain them would easily displace a much larger fraction. The use of diesel power on branch lines and in local and way freight service may sufficiently reduce operating costs to an extent that the pressure for abandonment would be greatly decreased. The diesel may yet save more jobs than it has cost.

V. OTHER RAILWAY LABOR AND THE DIESEL

A. Train Service Employees.

The engine service labor organizations have not been alone in regarding the diesel-electric locomotive as a threat to the employment opportunities and job content of their members. Almost every one of the unions concerned with railway employees have expressed fear in some degree. With some of the classes of employees this fear is doubtless just a fear of the unknown, of the new.

None of the labor unions concerned has been able accurately to assay the impact of dieselization upon its craft. Quantitatively the measure of diesel engendered displacement has yet to be made. Circumstances existing even at this stage of the development of diesel operations do not permit a definitive finding concerning its displacement effects.

Information as to this aspect of the "diesel problem" in the hands of either the carriers or the organizations is, in part, in the nature of hearsay evidence undiscounted by the forces acting upon railway employment through changes in the quantity of traffic.

Mr. H. W. Fraser, head of the railway conductors, writing in the union's magazine, could only generalize:

> I have before me information that the supplanting of steam power by diesel power washed out the work of 24 enginemen in passenger service, and 18 enginemen in freight service on a single railroad operating district in a single day's operation—with no change in the number of trains run. Other information is to the effect that the number of crews reduced amounted to 50 per cent of the crews needed prior to the replacement of steam power by diesel power. These

> changes, in addition to wiping out employment under double-header and helper district rules, also displace mechanics in shops and roundhouses, water service employees, clerical and telegraph department employees and others.[1]

Mr. Fraser said nothing about the problems created for his own membership by the advent of the diesel. However, this omission was not the result of any lack of concern with the problem. Many of the factors and characteristics which enter into the employment picture for firemen and engineers also act upon the conductors and other members of the train crew. Any reduction in the number of trains through dieselization would affect all train service employees and all have expressed fear.

The president of the Order of Railway Conductors again gave an indication of his organization's concern with the diesel in his report to the forty-fourth convention of that group:

> I have received a large number of complaints from our members on various railroads in regard to excessively long freight trains due largely to the use of diesel-electric power.[2]

Both the conductors and the trainmen have long been concerned with the matter of train length and their organizations have been instrumental in securing the passage of maximum train length laws and minimum crew laws in the various states. Such efforts to limit train length have had a double purpose. The longer the train, the more difficult is the job of the conductor and the brakemen. The

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[1]President's Page, The Railway Conductor, June 1948, p. 160.

[2]President's Report, Report of Officers and Committees to the Forty-Fourth Grand Division, Order of Railway Conductors of America, p. 353. An analysis of indices of time paid train service employees compared with indices of train miles, ton-miles, and passenger miles similar to that presented for engine service employees in Tables XI and XII indicated no significant displacement.

longer the train, the fewer trains need be operated to move a given volume of traffic. The train service employees thus act both in an attempt to increase employement for their members and to reduce the onerousness of their tasks.

The ability of the diesel to pull longer trains and heavier trains thus runs athwart the traditional interests of the labor groups among the train service employees. As has been indicated, train lengths most advantageous for the carriers from an operating point of view depend on many factors in addition to the ability of the locomotive assigned to move the load. The capacity of the yards at either end of the run, the number of cars which can be accomodated on sidings and passing tracks en route, the availability of traffic, the optimum time requirements for the run, and a variety of other factors enter into the operating decision as to the consist of the train. However, the ability of the locomotive to move the load over the territory between the terminals is one of the important factors.

It is possible that, as more roads adopt complete diesel operation and alter their physical plants so as to attain maximum efficient use of the new motive power, train lengths will increase significantly through dieselization. Passing tracks have been lengthened by some of the carriers to permit the operation of longer trains, centralized traffic control, which reduces the number of stops and waits trains must make in order to clear other trains, and other operating improvements have already made possible longer trains. In the future, this tendency may increase. A substantial increase in train length may lead to a degree of displacement, depending upon the nature and the volume of the traffic.

Historically, train length has increased over the years. Table XIII shows the increase in the length of the average freight train from 1925 through 1948.

TABLE XIII

AVERAGE NUMBER OF CARS PER FREIGHT TRAIN, 1925-1948*

Year	Cars Per Train	Year	Cars Per Train	Year	Cars Per Train
1925	43.8	1933	45.8	1941	51.3
1926	45.2	1934	46.2	1942	52.2
1927	46.5	1935	46.2	1943	52.4
1928	48.1	1936	46.8	1944	53.4
1929	48.6	1937	47.6	1945	52.5
1930	48.9	1938	48.1	1946	52.1
1931	47.9	1939	49.5	1947	53.2
1932	44.8	1940	50.7	1948	54.8

* SOURCE: Statistics of Railways, Table 60.

From Table XIII can be seen the gradual growth in train length over the period. It should be noted that the diesel has been in use in freight service only since 1941. Over the entire period, the increase has approximated one per cent a year. This rate of growth has also held true for the years since 1941. It appears that the advent of the diesel has merely continued the trend of the past. It is probable that the trend has been the result of increases in motive power strength, as well as other operating factors, and the diesel has continued this power increase.

However, no severe increase in train length with resulting displacement of train service employees can be seen in the data. Again, in this connection it is possible that isolated instances of significant changes in operating methods have been made by carriers which have displaced conductors and trainmen through increasing train lengths. However, when viewed on the total, national scene, these instances are not visible and the total picture is not one of threat. In addition, the speed characteristics of the diesel have permitted the roads to recapture some of the less-than-carload-lot traffic between major cities which formerly was carried by truck. This expansion of the merchandise freight service, resulting directly from the adoption of the diesel, with scheduled, fast-freight trains, may well create more trains than the power characteristics of the diesel remove.

The dual basis of payment, noted above in connection with engine service employees, is also in force for the other train service employees. However, for conductors and trainmen, the mileage requirements are based on 150 miles as a day's run, rather than the 100 miles of the engineers and firemen. This dual basis serves as a protection for the train service workers against speed increases exactly as it does for the engine service workers.

In short, it is easy to read into the diesel a threat to the employment of train and engine service employees, but it is not possible, on the basis of the evidence, to distinguish any real or significant damage to them as a result of the threat.

B. Maintenance of Equipment Employees.

Perhaps the most sweeping changes to the face of the railroads caused by the introduction of the diesel-electric locomotive has been in the area of maintenance. The reciprocating steam locomotive, although a precision piece of machinery, is essentially a metal monster. Precision in the fit of valves, bearings, pistons, tires, and certain of the appurtenances to the locomotive is a necessity. However, the device is a hardy one and can stand much abuse. The diesel, a combination of an internal combustion motor, delicate electrical control devices, electric generators, and electric motors, is a vastly different piece of machinery. It requires different skills for its maintenance than does the steam locomotive and a higher level of precision in more of its parts.

The diesel locomotive is an expensive machine and can justify its expense only when it is operating and drawing a train. The steam locomotive is a less expensive device and can be laid up for repairs more often and for longer periods of time without representing a really severe monetary loss.

The changeover from steam to diesel power has been far-reaching and truly revolutionary in its effect upon maintenance. The railroads were fully equipped with steam locomotives and all necessary servicing facilities for them, such as boiler shops, roundhouses, machine shops, blacksmith shops, fuel stations, water stations, cinder pits, etc. With the change in motive power, suddenly the greater portion of the existing shop and wayside facilities became obsolete—not suited to diesel operation. New shop facilities suited to diesel maintenance and overhaul had to be built; new skills on the part of employees had to be developed; new methods of maintenance and maintenance supervision had to be developed.

Shop facilities optimally located for steam operation, taking into consideration the most efficient length of runs, the nature of the coal and water used, the flow of traffic, and many other factors, may not be located correctly for diesel operation.

It had been considered good practice under steam operations to have the main shops of a system at one or more central points. Motive power fanned out from these points. The diesel, however, is a system-wide engine, capable of long runs requiring no coal and little water. The requirement for central shops under diesel operation is often entirely different than what it was for steam power. Careful studies have had to be made to determine where shop facilities should be located, and where to place servicing facilities. In this process, many shops were discontinued completely.[1]

As the larger railroads approached complete dieselization it was found that they had surplus shop space. Generally, the floor area required for diesel maintenance was less than that required for steam. Boiler shops, foundries, shops for the repair of tenders have no place in diesel operations. Even the machine tools required for diesel maintenance are different than those needed in steam.

With complete dieselization, not only are the shops and engine houses fewer, but those that are used are cleaner and offer better working conditions. They must be designed for handling precision motive power.

The job of overhauling a steam locomotive is one of tearing the machine down, repairing old or manufacturing new parts, and then re-assembling the machine. The job on a diesel is almost completely one of replacing parts, using parts supplied by outside manufacturers. Of necessity, facilities required for maintenance are vastly different.

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[1] J.B. Akers, "Effect of Diesels on Obsolescence," in: Railway Age, Vol. 130, No. 14, April 9, 1951, pp. 45-49.

The steam locomotive machine shop contained heavy machinery, boring mills, lathes, etc. The diesel shop has lighter and more expensive precision machinery designed and built primarily for inspecting, cleaning, testing and checking the many mechanical and electrical parts that function together in the diesel-electric locomotive.[1]

The demand for maximum availability of the diesel locomotives has caused shop engineers to recognize the necessity for installing every facility that will contribute to the elimination of man-hours of maintenance labor and to shortening shopping periods. Materials and parts handling equipment have been introduced to this end. These, together with the lighter nature of the work have lightened the work of the maintenance employees.

It should be noted, however, that most of the diesel power in use is relatively new. The maintenance picture is still in flux. Diesel shops thus far have been aimed at keeping the new power on the road. The nature of the future shop, when the diesel units are greater in number, older, and require more extensive and expensive rebuilding work, may be such as to bring back into the railroad shop many of the heavy production machines formerly used for steam locomotive repairs and now being used to build the new type of power.

Not only have the methods and requirements of maintenance changed, but also the managerial and supervisory techniques involved. With steam power, it was accepted that a road would have to own three locomotives for each two on the road at any one time. The third would be in the

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1 "The Changing Character of Shop Equipment," in: Railway Age, Vol. 129, No. 25, December 16, 1950, p. 33.

shop for servicing or repairs. With the more expensive diesels, there is no longer any surplus of stored power which can be called upon in emergencies to cover motive power failures or sudden and unexpected peaks in traffic.

The servicing and maintenance practice in the case of diesel power is predicated upon a completely new shopping concept—progressive maintenance of the diesels between runs with the use of exchange parts. The carriers no longer wait for a failure or near failure to repair the defective member. The aim in diesel maintenance is to prevent any breakdowns by scheduled repair or servicing of the various components. Components are removed from the locomotive for repair and are replaced by spare assemblies. The locomotive returns to the road using the new assembly, the old component can then be repaired at leisure without reducing the availability of the locomotive itself beyond the time required to remove one component and install another. The power is not tied up while the repairs are being made.

This method requires a closely controlled system of inspecting and servicing the locomotive. The unit exchange system with different classes of inspection, servicing, and overhauling done on a mileage or monthly basis as indicated by experience and manufacturer's recommendations. The diesels are maintained in this way, even to the extent of scheduled painting.

Many of the roads which use power from different makers, have distributed this power with all the locomotives from one manufacturer used in one area and those from another maker in use in another area. In this way, the spare parts inventory can be kept at a minimum and the maintenance employees gain an expert familiarity with the one make.

The specialization has been carried a step further on some roads by having the workers specialize in one or another of the basic parts of the diesel.[1] The all purpose maintenance man of the past does not fit into the diesel maintenance picture.

The Erie Railroad serves as a leading example of the new maintenance practices. This road has developed a highly complete record system for the entire road which has enabled advance scheduling of work so that availability and mechanical efficiency of the locomotives are kept at a high level. As a result, diesel engines in road service average approximately 11,000 miles a month. In contrast, steam locomotives on the Erie, while requiring more service at terminal points, are able to average only 6,000 miles per month in freight service. This increase in mileage has been accompanied by a reduction in the number of road failures as well as by a rise in the tonnage ratings of the power.

The switching locomotives are maintained on a monthly, quarterly, semi-annual and annual inspection basis based on the time in operation. Checks are made on these engines in the yard once each 24 hours.

Mileage records for the road locomotives are kept in the diesel-shop office. At 3,000 miles the road freight locomotive is held for a mileage inspection taking approximately five hours. At this time various items indicated for maintenance in 3,000 mile increments are also taken care of. At the completion of 100,000 miles of service this maintenance program begins again. At each 500,000 miles the diesel unit

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[1] "Re-Group and Centralize Shops," in: Modern Railroads, Vol. 6, No. 5, May, 1951, pp. 103-8.

is taken out of service for a period of four days and the engine, main generator and air compressor are removed. Previously overhauled components are applied to the locomotive. The same cycle is observed in maintaining the road passenger units except the mileage is doubled.[1]

Certain of the carriers have gone in extensively for reclaiming diesel parts, rebuilding them by welding and machining. Many of the reclamation techniques used have been the result of special study of the application of welding processes to rebuild parts and components subject to wear and requiring periodic replacement. The Atlantic Coast Line, for example, has built in its own shops tools and fixtures designed to aid in handling heavy or awkward sizes and shapes. Heat treating facilities have been installed to control the temperature of parts for most effective welding techniques and also to retain or restore the hardness and physical properties of the metal involved. The A.C.L. shop uses the inert-gas-shielded tungsten arc welding method for applying metal to worn portions of aluminum diesel pistons. With this technique, reclamation can be accomplished for approximately 10 to 20 per cent of the original cost.[2]

It can be seen that these new maintenance methods and requirements have changed the railroad shop situation rather drastically, have altered the labor requirements considerably, and have changed the job content of many of the maintenance workers. The more intensive maintenance required by the diesel, maintenance as a function of time or of mileage, the reclamation of parts, the increase in electrical component,

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[1] "Service Diesels for High Availability," in: Modern Railroads, Vol. 6, No. 5, May, 1951, pp. 93-7.

[2] "Diesel Parts Reclaimed by ACL," in: Modern Railroads, Vol. 6, No. 6, June, 1951, pp. 49-54.

the replacement of a boiler and cylinders by an internal combustion engine, have all led to tasks once unknown in railroad maintenance.

Some of the smaller railroads which have converted to diesel cannot afford and do not need the complete installation necessary for effective diesel maintenance. Some of these send the entire diesel locomotive back to the builder for general overhaul, or for heavy repairs after accidents. This is a practice which may grow as builders expand with more branch plants scattered around the country.[1]

The Railway Employes' Department of the American Federation of Labor (which includes the machinists, boilermakers, blacksmiths, sheet metal workers, electrical workers, carmen, and firemen and oilers) has indicated a concern with the changing nature of the maintenance picture. The Executive Council of the Department reported to its membership in April of 1951, in commenting upon the need for an employment stabilization program:[2]

> Meanwhile, we have become increasingly concerned over the situation which has developed, particularly since the last war. While there was some increase in employment during the war, over previous levels, the widespread introduction of the diesel-electric locomotive, as well as the purchase of a great deal of other new equipment by the railroads, have made serious inroads on employment among the mechanical trades, and the end is not in sight.

The Council went on to note that many carriers were contracting out maintenance work on their diesels to the firms from which they had

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[1] J. B. Akers, *op. cit.*, p. 49.

[2] *Official Proceedings*, Tenth Convention, Railway Employes' Department, American Federation of Labor, April 2 to April 4, 1951, Chicago, Illinois, pp. 62.

purchased them. The Electro-Motive Division of General Motors was singled out as having established maintenance facilities at various points throughout the country, where maintenance work for the carriers was performed. The report said that they also maintained a stock of parts, "all of which reduces the amount of work done in railroad shops."

They also indicated that technological developments had had a greater impact on the employees represented by the Department than, perhaps, on any other group. It was their view that a sound program to stabilize and increase shop employment should be developed and progressed as soon as possible, "while the situation is still fluid and before maintenance policies on the various railroads become crystallized."

The general lack of a definite appraisal of the effects of the diesel was also mirrored by this group:

> We have a survey under way to determine the facts with respect to the number of diesel-electric locomotives in operation, and the manner in which maintenance on this equipment is being done. Until the results are tabulated we cannot state precisely the extent of our problem . . . .[1]

The Executive Council went on to indicate that a preliminary check had shown that carriers had been reluctant to invest in the special facilities and machinery necessary to service the new equipment until their dieselization had progressed sufficiently so as to result in enough diesel work to justify the investment. This had necessitated a certain amount of contracting out of maintenance work. However, for the most part, the work contracted out by such carriers was confined to the rewinding of motors and generators and the overhauling of the diesel engines.

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[1] Ibid., p. 62.

No definite steps have been taken by any of the labor organizations except the engineers and firemen. Many feel that a threat is presented by the diesel but the engine service employees have been left to fight the innovation alone. Supra Chapter III.

In contrast, the Council had found, many carriers had built the necessary facilities to service the equipment at considerable savings to themselves. Said the group: "We are confident that with a sound program, vigorously prosecuted, we can persuade other carriers to do likewise."[1]

The Council indicated that it was giving continuous study to the problem and hoped in the near future to develop a complete program under which they would seek, among other things, to have all the maintenance work done by railroad employees. They would seek to end the contracting out of maintenance work and seek to stabilize employment by agreements with the carriers. In another area, the Department would attempt to encourage the construction of new equipment, such as freight cars, in the railroad shops.

The problem of construction of equipment has represented on many roads a source of employment for the mechanical crafts. Many of the major carriers would build some of their own steam locomotives in their own shops with their own shop forces. This practice is still followed by the Norfolk and Western Railroad, as indeed it must be by any carrier wanting steam power in any quantity as all of the major steam builders have changed over to the manufacture of diesels and have abandoned steam construction. The building, rebuilding, alteration, and modification of steam power in the carriers' own shops provided a major source of employment in the past.

Such individual construction has not been possible with the diesel. Most of the parts are much too specialized and the units too complex

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[1] Ibid., p. 63.

to permit manufacture in the average shop. The mass production methods more characteristic of the automotive industry and of suppliers to it which have been employed by the builders of diesel power, are not possible in a railroad shop. It is possible that as dieselization increases and carrier after carrier becomes completely dieselized, more and more of the heavy repair work will be done in carrier shops but it is extremely doubtful that any carrier will ever attempt to build its own diesel locomotives. Not only the problems of construction but the more complicated design of the new power renders such construction difficult in the extreme. The diesel is more amenable to assembly line techniques and the cost reductions possible under the mass production methods possible to the regular builders would not be available to the individual carrier. Economy of acquisition alone would appear to dictate purchase, rather than construction.

It is possible that the freeing of carrier construction facilities from locomotive building may result in the use of such equipment and space for the building of freight and passenger cars. Many of the carriers have built a portion of their rolling stock needs in their own shops in the past and this practice may well increase as more and more facilities are freed through dieselization. However, the reverse may also prove to be the case. In the absence of locomotive construction and rebuilding, the facilities may be too extensive to be fully employed by car construction. In that event they may well be scrapped and car construction abandoned by the carriers and relegated completely to the commercial car builders. In this event, the diesel will have reduced the employment opportunities for the mechanical crafts indirectly as well as directly.

One of the concerns shown by the Railway Employes' Department was with the new shop equipment being installed by the carriers in an effort to speed the maintenance of the expensive diesels and to reduce the labor costs involved in such work. The changing nature of this equipment has been discussed above and it can be appreciated that a labor organization might properly be concerned.

The importance of the problem recognized by the Department has also been appreciated by other labor organizations, some of them members of the Railway Employes' Department. Most of these, however, have been a bit more definite in their fears or demands. Several of the unions concerned with maintenance have discussed their own sectors of "the diesel problem" and have appeared to be aware of the changes that the diesel has wrought without being aware of their exact nature or extent.

An example of this is found in Resolution Number 16 of the 1948 convention of the International Brotherhood of Electrical Workers. This read in part:[1]

> Electric and diesel-electric power and equipment will in a very short time replace steam and we feel that the Electrical Workers today lose much of their work due to rules being very much out of date and we feel rules should be brought up to this more electrical date.

This resolution had been introduced by a railroad local and was adopted by the convention. It was not made clear in either the resolution itself or in any discussion of it just what work the Brotherhood

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1. *Proceedings* of the Twenty-Third Convention of the International Brotherhood of Electrical Workers, September 13-17, 1948, Atlantic City, New Jersey, p. 376.

members felt was being lost to them through inadequate rules. A possible hint was given, however, in Resolution Number 17 of the same convention:[1]

> Be it resolved, that our International chiefs be requested to secure for the Electrical Workers on railroads in America and Canada the positions of diesel electric maintainer while enroute and to further secure this through national movements and to revise our present rules covering this equipment while enroute as well as in terminals or shop points on railroad properties.

It appears that the engineers have not been the only labor organization to dispute the claims of the firemen to the engine room work. It will be recalled that the use of maintainers in the engine rooms of the diesels was more prevalent in the earlier days of their use than today, but the practice was being discontinued or decreased by many of the carriers even before 1948. Most of the carriers recognized that the electrical was the proper shop craft for employment as maintainers, but all hesitated to concede the use of maintainers to the union. Most of the difficulties experienced en route are of an electrical nature and if maintainers are to be used, the claim of the Electrical Workers deserves recognition.

For the year 1950, total repairs to passenger diesels on 33 representative roads cost 2.95 cents per passenger train car mile or 15.37 cents per locomotive unit mile. Of this 2.95 cents, the total labor component was 1.58 cents. The 1.58 cents was divided between engine repairs, electrical repairs, and other repairs. Engine repairs took 0.54 cents, electrical repairs took 0.36 cents,

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[1] Loc. cit.

and other repairs, 0.68 cents.[1]

A proper comparison between freight and passenger diesels cannot be made, but total repairs to freight diesels on the same roads cost 11.49 cents per locomotive unit mile, or 10.91 cents per one thousand gross ton miles (MGTM). Of the 10.91, repair labor accounted for 6.19 cents. The average labor cost for engine repairs on the 33 roads was 2.82 cents per MGTM, that for electrical repairs was 1.61 cents per MGTM, and other repairs averaged 2.20 cents per MGTM.[2]

The importance of maintenance in the cost picture for the carriers is indicated by the fact that, in passenger service, fuel costs were 13.59 cents per locomotive unit mile, compared to the 15.37 cents per mile for repairs. In freight service fuel cost 16.68 cents and repairs 11.49 cents.[3]

Members of the machinist craft are, for the most part, charged with the repairs to the engine. Many of these are represented by the International Association of Machinists. This organization has not neglected the problems raised by the diesel for its members although its approach has been a bit less phrenetic than that of other organizations. It, too, has the matter under study, but has devised variations in its apprenticeship rules which recognize some of the implications raised by the diesel.

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[1]"Special Statistics Evaluate Diesels," in: Modern Railroads, Vol. 6, No. 7, July, 1951, p. 41.

[2] Ibid., p. 40.

[3] Ibid., p. 41-2.

At the 1948 convention of the I.A.M. a resolution was submitted by Lodge 214 the subject of which was "Jurisdiction over machinist work on Diesel locomotives." The suggested resolution read:[1]

> Resolved that the General Chairmen Railroad Committee make a complete study and list all machinist work on diesel locomotives.
>
> That the Railroad Department of the A. F. of L. do everything possible to expedite any items of a jurisdictional nature.
>
> That this itemized list shall become a part of all Railroad Agreements.

The resolution was defeated on the recommendation of the committee to which it was referred. This is not to say that the Association did not approve of taking some steps in the area of the "diesel problem" but that this particular method was not thought advisable at the time.

Another of the crafts involved in the problem is the Boilermakers. These workers had had much of the work involved in the construction and repair of steam locomotive boilers and tenders. The work available to them on the diesel is limited, and, in part, challenged by the Sheet Metal Workers. Between these crafts the traditional and contractual dividing line has long been the gauge or thickness of the steel involved in the particular job. Thinner metal has gone to the sheet metal workers and thicker to the boilermakes. On the diesel there is relatively little thick metal as the use of alloy steels has permitted a reduction in gauge and weight in the few appropriate installations.

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[1] Proceedings 22nd Convention Grand Lodge International Association of Machinists, September 13-25, 1948, Grand Rapids, Michigan, Resolution Number 100, p. 256.

Both the Boilermakes and the Sheet Metal Workers unions have considered the problems raised for their crafts by the introduction of the diesel. Each has sought to expand its jurisdiction in an effort to maintain or to improve the position of its members. In the 1944 convention of the International Brotherhood of Boilermakers, Iron Ship Builders and Helpers of America an attempt was made to add to the constitution of the organization specific reference to the diesel:[1]

> Include in article defining Boilermakers' work, diesel locomotives and such work as is classified as boilermakers' work on steam locomotives.

Many other instances could be cited of the concern shown by the labor organizations for the job security and employment opportunities of their members so far as the diesel is concerned. Suffice it to say that all have approached the innovation with respect and with fear. The "diesel problem" is by no means solved either in the locomotive cabs, in the engine rooms, or in the maintenance shops.

The carriers and their maintenance employees have met the problems raised in a variety of ways. The new skills and demands of diesel maintenance have raised problems for both the employers and the employees. Critical problems of training have been created by the diesel. These have been met, for the most part, by the carriers with little assistance from the labor organizations. In the early days of the diesel, the carriers had to turn to the only source competent to advise

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[1] Proceedings of the Seventeenth Consolidated Convention, International Brotherhood of Boilermakers, Iron Ship Builders and Helpers of America, January 31-February 9, 1944, Kansas City, Missouri, Resolution Number 174.

and train maintenance workers--the builders. The shop forces and supervisors of the carriers themselves were not equipped for the training job.

The training problem is still a severe one. There were approximately 2,500 diesel units added to the rosters of the railroads in 1951. To maintain and operate this amount of new power (since virtually none of it went to replace diesel power) approximately 5,000,000 square feet of new shop space for diesel servicing and repairs was required. About 7,000 additional enginemen and firemen had to be trained to operate diesels, some 3,500 shop and service men and at least 350 supervisors had to be instructed in the special requirements of the diesel locomotive. Thus, about 11,000 railroad men worked on diesels for the first time in 1951. This presented a training problem of great magnitude.[1]

In the past, manufacturers' schools carried the major load of diesel training. That of the Electro-Motive Division of General Motors has given basic instruction to over 10,000 railroad men. In addition, two of the company's instruction cars have been used for classroom work by about 65,000 men on individual roads throughout the country.

Some of the carriers have equipped air-brake and other cars for diesel instruction and encouraged the establishment of diesel clubs at local shops. Correspondence school courses have been developed by the railroads in conjunction with the builders and existing

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[1] "Teaching Teachers at Electro-Motive," in: Railway Age, Vol. 130, No. 14, April 9, 1951, pp. 41-44.

institutions. The need, however, is a critical one and again the roads have called upon the manufacturers for assistance. A new, specialized course has been developed by the Electro-Motive Division school for the purpose of preparing railroad instructors to teach classes on individual lines. This course, a "Sixty-day Personalized Instructor-Training Program" was developed with classes limited to a maximum of four men. Most of the time is spent in the shop with an instructor to point out approved methods of reconditioning, building, and maintaining diesels.[1]

In view of this obvious displacement of the old, painfully acquired skills, the concern of the labor groups for the job content and security of their members is understandable. The situation of their members in relation to the diesel is a delicate one and not calculated to breed security. In addition to the psychic factors involved in this insecurity and uncertainty of craft and ability, the displacement of men as well as of skills is in the minds of workers and their organizations.

It is fully as difficult to measure displacement in the area of maintenance employees as in the other areas. As was indicated in Chapter II, the variations in maintenance work with rises and falls in traffic are severe. Roads which are partially dieselized use their steam power on a stand-by basis but keep their diesels fully employed. In the event of an increase in traffic beyond the ability of the normal complement of the diesels to handle, steam locomotives are taken out

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[1] Ibid., p. 43.

of storage and put into service. These are not properly maintained—certainly not to the extent they would be if they were in regular service—and carriers planning to add diesels are not likely properly to maintain steam power which is about to be replaced.

On the other hand, some of the carriers, looking forward to dieselization, have not purchased new steam power for a number of years. As a result they are operating with out-moded power which requires excessive maintenance if it is to be kept on the road at all. All of these factors serve to cloud the maintenance employee employment picture.

Table XIV compares the index numbers for traffic units and the mid-month count of employees in the various shop crafts. The relationships are much the same as might be expected, given the mechanical and electrical characteristics of the diesel, which increased greatly in importance over this period (from 23.1 per cent of the freight train miles in January, 1949, to 55.2 per cent in December, 1951).

TABLE XIV

INDICES OF TRAFFIC UNITS WITH EMPLOYMENT OF BLACKSMITHS, BOILERMAKERS, ELECTRICIANS, MACHINISTS, AND SHEET METAL WORKERS, BY MONTHS
1949-1951*
(January, 1949=100)

Year and Month	Traffic units	Black-smiths	Boiler-makers	Electri-cians	Machin-ists	Sheet Metal Workers
1949						
Jan.	100.0	100.0	100.0	100.0	100.0	100.0
Feb.	89.4	97.4	95.5	99.0	97.2	96.6
Mar.	94.1	90.2	89.4	91.2	111.2	93.7
Apr.	99.6	91.2	86.7	98.2	91.7	90.7
May	101.2	91.7	86.3	99.0	91.8	91.7
Jun.	97.2	89.1	83.2	97.6	88.2	88.5
Jul.	90.1	85.0	76.5	102.5	83.3	83.8
Aug.	96.2	83.1	76.1	97.1	83.3	85.1
Sep.	90.5	81.3	78.3	99.6	84.1	85.5
Oct.	82.0	65.2	65.8	94.6	75.0	76.2
Nov.	91.6	69.4	70.7	96.9	79.1	80.6
Dec.	92.3	79.5	79.5	101.8	86.8	89.0
1950						
Jan.	84.8	83.0	82.7	106.1	90.1	93.7
Feb.	73.4	79.5	79.0	105.1	87.7	89.6
Mar.	99.4	81.5	80.3	106.1	89.4	91.5
Apr.	97.4	86.5	83.3	109.8	92.0	94.6
May	100.0	77.8	76.1	99.1	81.8	85.6
Jun.	103.6	90.1	83.7	111.6	93.2	95.8
Jul.	104.5	89.6	84.1	112.2	93.6	96.6
Aug.	118.9	92.0	84.9	113.9	94.5	98.1
Sep.	114.8	93.3	87.8	115.1	96.1	99.5
Oct.	121.4	93.7	88.0	116.2	97.1	102.1
Nov.	113.5	93.9	88.5	117.1	98.1	103.8
Dec.	109.2	95.6	88.9	118.0	99.1	104.9
1951						
Jan.	113.3	94.6	88.8	119.2	99.8	105.7
Feb.	96.2	95.0	89.4	120.8	100.0	106.3
Mar.	116.2	96.0	89.6	121.2	100.6	107.4
Apr.	102.2	96.5	90.1	123.5	101.0	108.8
May	116.2	96.6	86.3	123.5	99.2	106.5
Jun.	113.6	94.7	83.0	123.7	96.7	103.9
Jul.	107.8	94.8	81.6	123.9	96.0	103.8
Aug.	121.0	94.5	81.1	123.8	95.8	104.0
Sep.	116.0	93.8	80.8	124.1	96.1	103.3
Oct.	122.9	91.3	78.8	124.9	95.1	103.5
Nov.	113.2	91.0	78.3	125.7	95.0	104.4
Dec.	107.7	90.4	77.8	125.2	95.1	105.1

*SOURCE: Wage Statistics of Class I Steam Railways, Statement M-300, Bureau of Transport Economics and Statistics, ICC. (Computed).

The importance of the electrical components of the new locomotives and the necessity for extensive maintenance of them may be read from the steady growth in the employment of electricians. This growth becomes even more apparent when the index of traffic units is examined in conjunction with it. Through the early portion of 1950 traffic continued near the levels of 1949. Through most of this period, the indices for the other shop crafts were depressed, but the growth of the employment of electricians continued in spite of somewhat lower traffic levels.

The boilermakers, again as might be expected from the maintenance requirements of the diesel, lost ground almost consistently and even the higher traffic levels of 1951 could not compensate for the loss of boilermaker work with the growing abandonment of steam.

Blacksmiths, needed for heavy repairs on steam power, also lost ground, but to a lesser extent than the boilermakers. It is possible that as the diesels age and heavier repairs upon them are necessary the blacksmiths will again be in demand. Here, however, the changing nature of the equipment used in maintenance work on the railroads will take its toll. Automatic devices for regulating the heat-treating of the metal being worked upon will remove much of the necessity for the skill of the blacksmith in this area. The reclamation of parts through welding noted earlier in this chapter may take up some of the slack, but in this area the boilermakers and the blacksmiths have yet to arrive at an agreement as to complete jurisdiction over welders.

The role of the machinists in the maintenance picture is a confused one. Their loss has been less than the boilermakers and the blacksmiths. There is still a place for the machinist in the repair of the engine, but at this stage of the use of the diesel, most of the repairs—quantitywise if not cost wise—are to the electrical components. It is probable that as the motive power ages and more and more mechanical repairs become necessary, the importance of the machinist in the maintenance routine will increase.

As was indicated in the discussion concerning the boilermakers and the sheet metal workers the lighter gauge material used in the diesel has led to little decline in the employment of the sheet metal workers. Although their number has not increased to the extent that traffic has increased, they have lost little ground absolutely and certainly none in comparison to the other crafts with the exception of the electricians. There is no reason to suspect that the future situation will vary greatly from that of the immediate past. Only in the event that the boilermakers expand their jurisdiction over the work involved will the sheet metal workers find themselves the victims of any great displacement by and through dieselization.

It appears that the advent of the diesel has exercised a greater effect upon the maintenance employees than upon the operating employees. Much of the work involved in the railroad industry has continued relatively unchanged by the introduction of the new motive power. Cars of freight and passengers must be moved over the road. They must be switched, serviced, billed, accounted for, etc., regardless of the type of motive power used to move them. The engine service employees have retained their operating duties as have members of the signal and communications departments. The maintenance of way and structures continues to be concerned with track, roadbed and structures. These have not been altered to any appreciable extent through dieselization. It is possible, although not probable, that complete dieselization after a number of years would begin to exercise some effect upon the track and roadbed. However, this time has not arrived and it is by no means certain that any great effect will be felt.

VI. SUMMARY AND CONCLUSIONS

Any examination of the problems posed by the introduction of the diesel-electric locomotive on the railways of the United States is inevitably impressed by the rapidity of the spread of this new variety of motive power. From its early introduction in 1924 to the present time, the diesel has made almost constant strides in the direction of its present importance. Introduced first in switching service, it did not expand its field of employment for some nine years when it first entered into passenger service. Seven more years were to elapse until it began operating in freight service to any extent worthy of the name. Since its introduction into freight in 1 941, it has spread until it is now the dominant form of motive power in that field.

To make such strides in such a comparatively short time the diesel has had to possess outstanding advantages. The steam locomotive, after over a century of development, was not to be idly replaced by any motive power less than as efficient or without a dominating superiority. The railways of the country had tried the steam locomotive and found it not wanting. Only the marked superiority of the diesel-electric as a form of railroad motive power enabled the new form of power to survive.

The diesel proved itself superior in several important characteristics. These included the ability to pull heavy loads at low speeds, thereby rendering it well suited for use in switching and in freight service; the ability to accelerate to operating speed quite rapidly, which made its use in all varieties of passenger service a move both toward economy and toward more efficient service; the ability to travel long distances without the necessity for adding fuel or water or req uiring other servicing, this made its use in through passenger and through freight service not only possible but desirable; the ability to utilize efficiently a comparatively cheap fuel, this enabled its application to be made in all kinds of railway service.

In addition to its operating advantages, the diesel had a comparative freedom from repair and maintenance requirements which enabled it to ring up records of availability and low maintenance costs. This in turn enabled the locomotives to spend more time on the road at work. The higher first cost of the diesel could thus be amortized and its operating advantages taken full advantage of.

Another of the factors which recommended the diesel to the carriers was its comparative cleanliness in operation. This was particularly important in switching service in cities and towns. It was in this class of service that the diesel first rose to dominance.

All of these advantages were responsible for the rapid and widespread adoption of the diesel. Recognized as an innovation by the carriers, it was also recognized as an innovation by the railroad employees. The labor organizations representing the workers who came into contact with the new form of power were not slow to suspect the new motive power of representing a threat to the crafts and the job security of their members. The unions reacted in the same manner that other unions in the past, presented by a technological development, had chosen.

Some of the railway unions attempted to combat the new device through the medium of restrictive rules and practices. The two engine service brotherhoods, the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen both attempted to force the carriers to employ a second member of their craft on the diesel for duties in the engine rooms. The carriers had recognized the operating necessity for having both an operating engineer and a fireman (helper) on each locomotive, despite the fact that the generation of power no longer depended upon the fireman. However, apparently feeling that the diesel, with its ability to pull heavier loads, represented a definite threat to the employment of engine service employees, both of the organizations demanded the employment of a second member of their seniority list for the purpose of performing routine inspection and maintenance tasks en route. When the carriers refused these separate demands, the unions threatened to strike. Operating under the terms of the Railway Labor Act, the President in three instances appointed an Emergency Board to hear the claims. In each of the cases, a joint proceeding in 1943, the Engineers' case in 1949, and the Firemen's case in the same year, the Boards rejected, almost in entirety, the demands. In the first case the Board did concede and recommended that the fireman (helper) remain in the cab at all times in high-speed, main-line passenger service. In the event that another man were to be added to perform the work customarily done by the fireman, he should be taken from the ranks of the firemen. In both of the other cases the union failed to win a point.

The present situation is just as it was after the 1943 case. Two men are employed on each locomotive in road service and in yard service on locomotives weight over 90,000 pounds on drivers. One of these men is taken from the ranks of the engineers and the other is a fireman. From an operating point of view, from a safety point of view, this two man crew is necessary. None of the Boards was able to find in the evidence and testimony of the labor organizations any justification for the employment of an additional man on the diesel locomotive. The present investigation has not brought to light any additional facts which would lead to disagreement with the Boards.

It also appears that the fear of the Brotherhoods that dieselization would lead to the displacement of their members has, as yet, no justification in fact. It is admitted that complete dieselization may well alter the present picture. However, this event is not likely to take place in the near future, if at all. It is certain that the ups and downs in the volume of traffic have been, in the past, the cause of much more unemployment and under-employment than the diesel could ever account for. To the extent that the cost advantages of the new power enable rate reductions or inhibit rate increases and thereby stabilize to some extent the traffic load of the carriers, the diesel will have contributed to stability of employment, rather than to the reverse.

The dispute between the various crafts as to the jurisdiction over running repairs en route has involved the engineers, the firemen, the electricians and, to a limited degree, the machinists. At the present time this work is done either by firemen, maintainers who are members of the shop crafts—usually electricians—or by so-called supervisory employees. This dispute is by no means at an end and the probabilities are that it will continue as an active issue in negotiations between the unions and the carriers as well as the subject of controversy between the labor organizations.

So far as can be seen from the available evidence, it is only in the case of the maintenance crafts that dieselization has led to any significant changes in employment opportunities. The very nature of the diesel is such that the maintenance requirements are vastly different from those of the steam locomotive. In many respects, a higher degree of skill is required from the shop crafts. Many of the tolerences to which they must work are more severe. Many more of the machinery and controls are electrical in nature, many of the parts are lighter, most of the machinery operates at higher rotational speeds than is the case with the steam locomotive.

These maintenance characteristics are reflected in the employment relationships over the past three years, when the diesel has had a rapid growth. The electricians have increased their employment, the sheet metal workers have gained slightly in relation to the other metal working crafts, the machinists have lost ground as have the blacksmiths. The boilermakers appear to have borne the brunt of the change in maintenance requirements. The work on the boilers and tenders of steam locomotives formerly provided the bulk of their duties. The absence of work of this nature on the diesel has spelled rather severe displacement for this craft. There appears to be little chance that their craft can regain its former importance in the railroad maintenance picture, so far as locomotives be concerned, except at the expense of other of the maintenance crafts.

So far as the rest of the railway employees be concerned, the diesel represents merely an extension of a trend of long standing toward more and more powerful motive power. To the extent that this trend in the past has represented any threat to the employment of any of the callings, the diesel has continued that threat and has possibly increased the tempo of potential displacement. For such employees, however, the diesel does not represent anything completely new or different. In any event, even with traffic slightly over half dieselized at the moment, the degree of dieselization is not yet great enough to permit any generalization on this score.

It is altogether possible that the economies of the diesel are such that almost complete dieselization will permit the recapture of traffic lost to the rails and result in increased, rather than in decreased employment for almost all of the occupations. Certainly the rail transportation net work of the country is important enough to it economically,as well as from a military point of view, so that an increase in efficiency of the magnitude permitted by the adoption of the diesel-electric locomotive cannot but help to benefit the country and the economy in the long run. The price for this benefit in terms of technological displacement of workers promises to be so low that the country cannot afford not to pay it.

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