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CHAPTER 2

Soviet Railroad Traffic

Statistical Measures

The principal statistical measures of railroad freight traffic for the Soviet Union are available, or can be approximated from the reported relationships of available data to other years, for the whole Soviet period and for the base year 1913, except for some years for which interpolation has been resorted to in some series. More doubt surrounds the data for the period of World War I and the subsequent civil war than for the later years before World War II. Scant evidence is available for the war years, but a relative abundance of material on the immediate postwar period is available, together with substantial detail for the last decade.¹ Moreover, there are difficulties of territorial coverage, particularly during the revolutionary period, when the effort to assemble statistics from reports of the several railroad administrations after the event results in gaps as well as doubt on the portion of traffic covered. Limited significance should be assigned to the data for 1916-20. At a later period, difficulty is encountered in allowing for absorption of the lines in eastern Poland because it is impossible to segregate the Polish railway traffic data for the prewar years. On the whole, however, the available data give a general view of the aggregate output of the Soviet rail plant in familiar terms, viz., metric tons originated, carloadings, and metric ton-kilometers (at least two of these series are subject to a probable overstatement). In the study of all series, care should be taken to observe the years when territorial coverage changes.

The student familiar with Western rail statistics is at once confronted with the necessity of understanding precisely what the Soviet data purport to show. He must beware of direct comparisons with Western data which are derived in some instances from different documentary sources, may be designed to serve somewhat different purposes, and are compiled under accounting concepts that are sometimes more rigorously applied and policed. The concept of tons

¹ The reader should be cautioned to read with care the introduction to Appendix C. An effort has been made not only to secure the Soviet statistics, but also to fill out the series with the most probable estimates in the absence of direct Soviet data. As will appear, the statistics, even when available, frequently misrepresent the facts or differ in concept or in coverage from U.S. series which are nominally similar.

originated does not appear to differ from that employed in this country, except that double counting does not seem to be positively avoided in the case of tonnage first loaded on rail cars, subsequently transferred to a water haul, and later reloaded on railroads. The Soviet literature appears to contain little discussion of such rail-water-rail movements, but it is apparent that, although a certain amount of such traffic existed on river and maritime routes in the early 1930's, efforts to stimulate these joint hauls have not been as successful as desired and they represent very small tonnages in relation to total rail freight. Similarly, the carloadings appear to be analogous to those compiled by the Association of American Railroads rather than those published by the Interstate Commerce Commission. The latter refer to carload traffic only (including forwarder traffic) and treat through rail-water-rail movements as though they were continuous carload movements, which are represented by a single car count at the initial rail origin. One difference between the Soviet system and that of the Association of American Railroads is that cars received from connecting lines of other countries are recorded as carloadings in the USSR. This is believed to represent a relatively small element, but to the extent that it exists it tends to overstate Soviet loadings in comparison with those of the United States, especially for recent years.² Volumes of traffic between the USSR and the satellites to its west as well as Red China have certainly grown considerably.

The Soviet carloading data are, however, given in two-axle units rather than in actual cars since the mixed fleet composed of two-axle and four-axle cars requires a common denominator.³ Moreover, tank cars are weighted by nominal weight capacity on a scale which disregards the actual number of axles in cars of more than two axles. Thus, up to nineteen tons capacity, they are counted as one conventional unit, twenty to twenty-five tons as two such units, twenty-six to forty tons as three, and over forty tons as four. Hence Soviet load-

² This same lack of comparability probably exists for the data on tons originated. It was reported in late 1959 that traffic between Eastern Europe and China across the USSR is now a complicating factor.

³ Like railroads in other parts of the world, the Soviet system has a few heavy-duty cars carried on more than four axles for oversize and exceptionally heavy single-piece shipments. Some three-quarters of the Soviet cars are now four-axle ones, largely of design similar to some common in the United States in the late 1920's. The European type of two-axle car still makes a substantial contribution to Soviet rail traffic performance not only because of its number, but also because it is adaptable to small carload shipments, and hence it is not to be regarded as entirely obsolete. Moreover, the two-axle car usually has greater cubic, in comparison to weight, capacity than four-axle cars—a factor which helps attain a high load factor with this type of equipment.

ings as reported should be reduced by one-half to secure a series roughly comparable to that of the Association of American Railroads for the United States. It is further to be noted that the Soviet system reports average daily carloadings, whereas the custom in the United States is to report aggregate carloadings weekly, quarterly, and annually.

A less obvious, but more important, difference must be noted in the ton-kilometer data. As ton-kilometers reflect both the tonnage loaded and the distance over which it is moved, they afford the best measure of a carrier's freight traffic performance. Moreover, in view of the transfers from one type of transport to another which give rise to duplications in tons originated data—each form of transport treating the traffic as originated when received even though delivered by a connecting carrier of another type—ton-kilometers alone can be aggregated to secure a measure of the complete freight traffic output of a transport system. The Soviet system reports two series for ton-kilometers. One, which they call "tariff" ton-kilometers, is more regularly reported in absolute figures in Soviet publications. The second, which they call "operating," purports to be actual ton-kilometers.⁴ Tariff ton-kilometers are not a direct measure of the physical work produced by the railroad system. In effect they record the ton-kilometers that would have been produced had the traffic in all instances moved over the short tariff routes or the routes approved for plan purposes.⁵ They do not record the ton-kilometers produced when traffic actually moves over routes other than the short tariff or plan routes.

⁴ It is hoped that the tariff series is a homogeneous one, representing tariff ton-kilometers computed from originated waybills (waybills at the point of issuance). But it appears probable that terminated waybills (waybills received at destination stations representing completed shipments) are used in the postwar period. An alternative system records short tariff distances between each junction stamp on the terminated waybill. For any given time period, there is a different population of waybills employed in these two computations. The terminated bills are apparently used for division of revenues among the several railroads. Alternatively these two statistics may be called "revenue" and "performed," respectively.

⁵ These data are compiled from the freight waybills on which the station agent at origin enters the tariff distance (the shortest physical route regardless of practicability as shown in Tariff Handbook No. 4 via prescribed or approved junction points between railroads). Junction points for routing purposes may be altered in successive semiannual plans for the making of trains or by order of the ministry. Internal routing on any railroad may differ from the mileage entered on the waybill. On certain routes terminal arbitraries (distances arbitrarily established regardless of the actual distances) are employed, as in the case of Moscow where fifty-four kilometers are added to all through routes representing one-half the length of the belt line (*Kratkii tekhnicheskii zheleznodorozhnyi slovar'* [Brief Technical Railroad Dictionary], Moscow, 1946, p. 507).

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The United States statistics show the ton-mileage actually performed over the route of movement. Moreover, the Soviet concept of a short tariff route does not exactly correspond to the similar concept in the United States as defined by the Interstate Commerce Commission in prescribing rate scales. Our rate-making distances are not necessarily the shortest routes over which traffic can be moved without transfer of lading, although they tend to approximate such distances. Regardless of changes in actual routing practices, these rate-making distances remain undisturbed except by changes in the physical plant. The Soviet tariff distance, however, purports to represent the shortest route between any two points over which traffic can be worked via the specified junctions. The relative simplicity of the Soviet system of lines, as well as its organization into regional groups of lines, eliminates the problem of a variety of competing multiline routes. Insofar as the tariff ton-kilometers are computed from the originated waybills in a given time, in a period of expanding traffic they tend to overstate the annual ton-kilometers by as much as three to four days' traffic.⁶

A second difficulty, which applies to both the Soviet ton-kilometer series, is that they include company material moved in "commercial" trains, though they exclude the movement of such material in non-revenue trains. Hence they are not comparable with the revenue ton-mile series for United States roads, nor are they quite comparable with our net ton-miles, revenue and nonrevenue. This last fact results, however, from different relationships in the movement of company material in work and special trains, the Soviet system having a relatively larger movement in such trains. The nearest comparison is, therefore, with our revenue and nonrevenue net ton-miles, and for most purposes this will suffice.⁷ It should be noted, however, that since it has not been possible to separate out the company material

⁶ U.S. railroads formerly used the waybill method for computing ton-miles, but because of the resulting overlap and the delays pending a closing out of interline waybills, the use of conductors' wheel reports was required by the U.S. railroad administration during the first war (see J. L. White, *Analysis of Railway Operations*, 2nd ed., New York, 1946, pp. 229 ff). This had the effect of recording in any period the ton-miles actually performed in train service. Most American railroads maintain their revenue accounts, however, on a received basis (see E. H. Bunnell, *Railroad Accounting and Statistics*, Chicago, 1955, p. 34).

⁷ Certain minor differences no doubt result from a lack of common treatment. Thus Item 63 in Rail Form A, annual report to the Interstate Commerce Commission, includes a proportion of the weight of exclusive work equipment based on the relationship of net ton-miles to gross ton-miles for the reporting period, a wholly arbitrary inclusion. The same item includes water transfer service on the Great Lakes involving a rail-line haul, the revenue from which is includible in Account No. 101. We are unable to ascertain in similar detail the specific content of the Soviet series.

from the Soviet series, this series includes not only the traffic hauled for shippers, but also most of the tonnage hauled for the maintenance, construction, and working of the railroads, and should not be mistakenly compared with the revenue ton-miles of U.S. roads. Since the Soviet system until recently has operated primarily on steam (which requires much larger tonnages of fuel than does diesel power for an equivalent performance), since the state of its locomotive technology must result in a rather high consumption of coal per thousand gross ton-kilometers, and since the haul of company material undoubtedly averages longer than that in the United States, a larger proportion of the ton-kilometers no doubt represents traffic required to meet the needs of the railroads themselves than is the case in the United States.

We have been able to develop a less complete and a much less certain series for operating ton-kilometers. Were the series as soundly based on published Soviet data as the tariff ton-kilometer series, and were the Soviet data based upon documents as well supervised as our conductors' wheel reports, it would certainly afford the most accurate measure of the actual physical work of the Soviet railway system. For it is derived from engineers' trip reports which purport to show actual net ton-kilometrage, including the differences between the route of movement and the tariff route and between actual origin or destination and the nearest agency station from or to which the traffic is billed. Hence it corresponds in concept closely to our net ton-miles, revenue and non-revenue, and is derived from a similar primary document. Unhappily a wide variety of evidence suggests frequent falsification of engineers' trip reports in the direction of overstatement.⁸ As the disparity between the two ton-kilometer series has been rather steadily reduced and now is of the order of 1 per cent, it may be that these inaccuracies have been brought under control. Direct data are available for 1930-38 and 1940. The relationship of operating to tariff ton-kilometers is given for certain other years and permits a direct computation. Since a great effort is made to reduce the disparity between the two series—the excess of operating over tariff ton-kilometers being commonly regarded by Soviet administrators as “wasteful” transportation—the movement upward or downward in particular years is frequently given

⁸ Audit practices appear to be loose. Crews have incentives to overstate the tonnage of trains in order to overstate gross ton-kilometers and thus benefit from the premiums paid for fuel economy. Instances are recorded of the train tonnage being reported separately in total by each engineer of a double-headed train. *Gudok*, the newspaper of the Ministry of Transportation, from time to time cites such cases which probably are but samples of a widespread practice. Kochetov attributes some of the excess of operating ton-kilometers to engineers' overstatement of tonnage.

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in percentages.⁹ The use of percentage relationships so far removed from the desired datum of course introduces large possibility of error in the result. Interpolation has also been necessary to fill out the series.

The question arises, in connection with the traffic statistics, whether the pressures which assail Soviet shipping industries and Soviet railroad administrators may result in misrepresentation which produces an upward bias. This is a particularly vital question because of the usefulness of accurate traffic statistics as a measure of economic growth. No entirely satisfactory answer has been obtained and in the end it is necessary to rely on judgment in appraising probable reliability. We are inclined to regard the tariff ton-kilometers as a reasonably accurate representation of the facts which they purport to convey, subject to a moderate upward bias which we are unable to estimate since Soviet authorities themselves are unable to put a value upon it.¹⁰ It has been suggested that the billed tonnage may exceed that actually loaded in view of the emphasis placed upon heavy carloading and the penalties which may be brought to bear on shippers for the misuse of rolling stock, and this suggestion appears to have merit. The high performance recorded for average carload and average car turnaround between loads tends to support this view. Perhaps the tendency merely counteracts the tendency, present in all countries, to underbill in order to reduce charges, but the tenor of official statements suggests a considerable lack of concern about freight charges on the part of Soviet industry.

The quarterly plan procedure, with its monthly breakdown, represents a cooperative endeavor between shipping ministries and the Ministry of Transportation and its railroad administrations to establish norms for static carload which govern the supply of cars to individual shipping installations. To be sure, there is evidence of negligence in plan enforcement as well as in the planning process itself, but nevertheless the plan must have some influence. Moreover, the loading norms for various commodities appear to be well adjusted to the loading capacities of cars and are, in this sense, practical. Yet penalties

⁹ Some of the disparity is, of course, unavoidable. Overemphasis on the short routing of traffic may also result in congestion of the direct lines and in less efficient use of equipment where the movement is slower or faces greater physical obstacles than via less direct routes. Little attention appears to be given to these factors which influence much internal routing in the United States, although they undoubtedly affect daily operation. Soviet analysts are aware of them, but the overemphasis of simple objectives on occasion encourages inefficiency.

¹⁰ As will appear, there are numerous instances of bias in the Soviet statistics which tend to reinforce one another and the recognition of which promotes a better understanding of rail performance, even though the degree of bias cannot be determined.

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for ordering more cars than can be loaded are relatively low, while the pressures to be certain of an adequate car supply are great. Over-ordering of cars appears to be a fairly common phenomenon which provides both opportunities and incentives for light loading and over-billing to conceal this departure from efficient practice.

We have discovered no Soviet equivalent of the weighing and inspection bureau or of other checks on the accuracy of shippers' scale weights and billed weights. Reliance seems to be put primarily on weighmasters and station agents. An annual sample weighing of some 300,000 cars is made at check points. Industry scales under the supervision of railroad test forces appear to exist very rarely and the evidence suggests that a great part of Soviet rail traffic is billed and moves without a scale weight being taken. Much bulk traffic moves on estimated weights derived from a rough approximation of the cubic space occupied multiplied by the average weight of the commodity per cubic meter. Visual inspection of open-top cars thus loaded provides a rough check on whether they are well or lightly loaded, but can be highly deceptive when a wide range of commodities is involved and when the inspection is made at different points in transit.¹¹ In any event, the results of the sample weight checks disclose a consistent overstatement of actual weight in the billed weight from which statistics are compiled. The degree of overstatement is reported to average from one-half to three tons per car.

Given an overstatement of tonnage in the waybills, not only tons originated but also tariff ton-kilometers are overstated. There seems to be little likelihood of consistent or important overstatement of tariff distances since the compilation from destination waybills, on which the route is recorded by stamps at origin stations, junctions, and destination stations, affords an audit check on proper application of the published table of shortline distances. In most respects, however, the internal audit system has not been investigated. Elsewhere we will discuss the evidence available from the operating statistics which lends credence to the recorded traffic performance.

Growth of Soviet Rail Freight Traffic

The Soviet railroads began to show firm signs of recuperation from war and revolutionary conditions in the fiscal year 1922/23, but it was not until 1928, after steady growth, that the 1916 volume was exceeded.

¹¹ Loads of coal and other bulk commodities tend to consolidate after they have been in motion for some time and appear less well loaded at destination than at origin.

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Contemporary accounts by foreign observers record both the disorganization prevalent in 1921 and the slow steps toward recuperation,¹² which took effect with more firm administration in 1923,¹³ although physical rehabilitation presented problems which could only be coped with gradually and required substantial import of technical personnel, motive power, rolling stock, and other equipment.¹⁴ This importation has had lasting effects on Soviet railroad technology and operating practices and may well account, in lieu of the designed initiative of the Soviets, for the adoption of features characteristic of U.S. technology. The Soviet discussions refer to their policy, however, as an effort to adopt the best of West European and United States practices. This appears to be largely a rationalization for the long continuance of a mixed technology, although some arguments can be found for continuing in service a proportion of European-type equipment.¹⁵

An annual growth of 20 billion ton-kilometers after 1928 slowed down in 1932 and came to a halt in 1933, producing the "transportation crisis" of the early 1930's which has been the object of considerable attention by analysts in the English-speaking world. Retardation of the rate of growth, of course, accompanied the fairly steady absolute growth in the late 1920's and in 1930 and 1931. Equipment importations, except to secure the benefit of foreign technological developments, had largely stopped after 1931, while domestic equipment production was undergoing considerable expansion, although falling short of plan. As Holland Hunter demonstrates, however, the share of railroad investment in total investment declined substantially under the First Five Year Plan by comparison with the late 1920's.¹⁶ This

¹² See the report of the American Relief Administration quoted in *Railway Age*, Vol. 72, 1922, p. 92, and the account of Captain Geoffrey L. Carden in *Railway Age*, Vol. 74, 1923, p. 72 ff.

¹³ Sidney Brooks supplies an account of the beginnings of recuperation in *Railway Age*, Vol. 76, 1924, p. 129 ff.

¹⁴ Mr. Ralph Budd, subsequently president of the Burlington System and dean of American railroad presidents, actively headed the study of Soviet requirements and the planning which lead to recommendations by his mission for rehabilitation and expansion. A strong German influence is also apparent, reinforced by a considerable import of motive power and other material manufactured in Germany.

¹⁵ Drucker makes the point, important in considering the significance of the Soviet experience for underdeveloped countries, that the USSR inherited a good transportation system. Notwithstanding the inability to support the mass military operations of World War I, this is, of course, true. The problem of the 1920's was one of rehabilitation of a system of considerable size which had once been well equipped. See Peter F. Drucker, *Landmarks of Tomorrow*, New York, 1959, p. 169.

¹⁶ Holland Hunter, *Soviet Transportation Policy*, Cambridge, Mass., 1957, pp. 54 and 71.

limitation of investment apparently affected all phases of rail plant and not merely motive power and rolling stock.

In the development of the First Five Year Plan, which was launched in the fall of 1928, it is clear that considerable attention was paid to the relation transportation development should bear to the industrialization program. The background is admirably treated elsewhere and need not be repeated here,¹⁷ but we may be permitted a few comments upon strands of policy which, modified to cope with events, have persisted to the present day. As Hunter points out: "Received Soviet doctrine sees only that transportation diverts resources from producing output." The planning work and the published discussion—then more free than at later periods—of both the State Planning Commission and the Commissariat of Means of Communication are similar to those in the Western world during times of war pressure. The relation of transportation to industrialization as a whole set forth for the First Five Year Plan is characteristic of not only Soviet planning, though it has not been carried to similar extremes elsewhere, nor has it been extended to become parts of long-term policy elsewhere. Nowhere has it been adopted, either, when the basic plant was already weak for the job to be done or where such a large, continuing expansion of the needs of the economy was anticipated. In both the Soviet Union and the Western world the same arguments are advanced in wartime: rationalizing industrial locations and their supply, minimizing hauls in distribution, and intensifying the utilization of physical plant. The Soviet planners talk like the officials of a war production agency which is bent upon securing the utmost conservation of resources in such services as transportation in order that resources may be freed for other purposes which are viewed as more vital for immediate objectives. But the propositions, which in a Western country in wartime may be viewed as a temporary stretching of a basically adequate and somewhat elastic transportation capacity, become in the Soviet Union relatively permanent attitudes. In both cases they trade heavily upon theoretical technical possibilities but overlook the imperfections of the human tools and the motives that detract from maximum physical efficiency. Yet the Soviet administration was successful in one instance in clearing up a shortage of transport and restoring a modest traffic growth with limited help from increased physical plant in late 1933 and 1934. The restoration of a reasonable equilibrium with growth in the industrial sector, however, had to await increased investment in the railway's plant.

¹⁷ *Ibid.*, Chapter 3.

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During rapid industrialization the same conflict of demand for scarce resources becomes strategic as in war. A calculated risk is required, otherwise the heavy demands for steel and machinery for a similar percentage growth in the railroad system will tend to defeat the major objective of timing. This is particularly true in the case of the expansion of heavy industry, for the primary requirements of railroads are for the heavy structurals, castings, and forgings whose production capacity is limited and which are much in demand for the expansion of the manufacturing plant, including the steel industry itself.¹⁸ A certain myopia pervades the planners in transport matters, theoretical efficiencies are treated as if they were actual, and the experienced transport operating officials are viewed as hopelessly conservative to the point of obstructivism. As a spur these attitudes are, no doubt, useful but when allowed full force in determining investment they may result in unexpected failures. The remarkable flexibility of a railroad system in the absence of interrailroad competition and commercial objectives and under strict discipline has been demonstrated in more than one country and on many occasions. But the Soviet planners may have cut too fine, although the reasons for the inadequate transport in 1930-34 also included the fact that the plan for output and delivery of major items of transport equipment was not fulfilled and that traffic demands increased more than anticipated. The average haul notably failed to respond to the prescribed treatment and increased with some promptness rather than falling. Nor is it clear that a wise distinction was made between the demands imposed upon motive power and rolling stock by an increase in tonnage originated as distinct from an increase in ton-mileage resulting from an increase in the average haul. An equivalent increase in ton-mileage from the latter cause is conducive to improved equipment utilization and makes proportionately less demand for railroad plant expansion, except for main-line capacity. Even if length of haul had been held within the planned limits, it is doubtful that the proposed expansion of rolling stock would have been adequate to cope with the expected tonnage originated.

The evidence from the Soviet statistics is not clear-cut, yet it bears some of the marks of congestion as the proximate cause of shortage of cars for loading. The growth of operating ton-kilometers slowed down before 1932. In 1933 ton-kilometers fell off slightly (see series C-6 in Appendix C). Carloadings likewise fell in 1933 after a very

¹⁸ Care must be taken to work out requirements and availabilities in a shape and form breakdown if a correct appraisal of a railroad program is to be secured.

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modest growth in the preceding year (see series C-4). Average carload appears to have held rather steady, except for a slight dip in 1932 (series C-5), and tons originated were virtually the same in 1933 as in the preceding year. Increase in the length of haul ceased in 1933. The backlog of unshipped freight was reported at 20 million tons at the end of 1932 and stood at the same level at the close of 1933. By the end of 1934 a reduction to 15 million tons had been effected.¹⁹ It would appear that the car shortage, which was the immediate manifestation of inadequate transportation, was produced by a growing difficulty in the movement of cars through yards and terminals and on the line. Of course, it is possible that, had circulation been as free as in earlier years, car shortages would have developed from other causes, notably from the failure of investment in rolling stock to keep pace with the growth of traffic demand.

Available monthly data for 1933 show that the greater part of the difficulty was concentrated in the winter and early summer. An improvement occurred in the late spring, and the fall performance exceeded the comparable period of 1932, as can be seen from Table 7.

TABLE 7
AVERAGE DAILY CARLOADINGS, USSR, 1932-33, BY MONTH

	1932	1933
January	52,658	46,310
February	48,365	46,399
March	49,327	48,325
April	54,024	52,239
May	55,417	53,812
June	53,031	51,896
July	48,815	49,950
August	48,565	51,059
September	52,525	54,087
October	53,621	56,126
November	50,924	55,431
December	49,665	48,861

SOURCE: I. V. Kochetov, *Statistika zheleznodorozhnoi transporta* [Statistics of Railroad Transportation], Moscow, 1941, p. 61; *Socialist Construction in the USSR*, Moscow, 1936, p. 340.

Thus it would appear that severe winter conditions may have impeded operations in the early months of the year and contributed to a congestion which was difficult to clear up. There is some evidence to suggest that maintenance standards had deteriorated to the point of having an adverse effect upon operations. Thus there appears to

¹⁹ See Hunter, *Soviet Transportation*, pp. 52-54, for a more extended account.

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be an increase in accidents both on the line and in yards. Line-haul movement slowed down primarily from a drop in running speed between terminals, suggesting that poor standards of line and locomotive maintenance, as well as, perhaps, poorer quality of fuel, may have been contributing factors. This view is somewhat reinforced by the modest decline in gross trainload. Operating personnel declined in number somewhat and it is possible that an increase in crew overtime contributed to declining performance. Quite possibly the consequences of neglect beyond mere limitations of capital investments were being felt.

Certain other features of the 1933 performance are worth comment. Tariff ton-kilometers showed a small increase in 1933 and the excess of operating over tariff ton-kilometers grew from 4.25 per cent in 1933 to 5.67 per cent in 1934, perhaps an indication of increased line-haul congestion. Empty car-mileage evidently grew by nearly 10 per cent between these two years, a phenomenon contrary to that expected under heavy traffic pressure in competitive systems, but which can perhaps be explained by efforts to relocate cars and to give priority to certain traffic in car placement (see series C-33). Centralized distribution of empties by the Ministry of Transportation for so widespread a rail system need not be expected to work as the car service rules do on American railroads. Arbitrary car relocation here never affects more than a very minor portion of the supply. Both freight car and locomotive turnaround were more sluggish in 1933, thus depriving the plant of a capacity equivalent to its output in the previous year.²⁰ And this weakening of rail performance occurred in the face of some increase in the volume of traffic, a circumstance which is usually favorable to increased operating efficiency.²¹

By studying the growth of freight backlogs, Hunter attempts to appraise the inadequacy of rail transport during this critical period.²² From the available data it does not appear that there was a major pile-up of unshipped freight, although substantial tonnages were awaiting transportation and the volume reached a peak in 1933. How-

²⁰ Both train speed and locomotive-kilometers per locomotive-day declined, indicating a slowing down of line-haul performance without, however, giving any direct clue to reasons. This plus the increased haul of empty cars was probably more influential in the lengthened freight car turnaround than deficiencies in the shipping ministries in loading and unloading cars. The composition of car turnaround does not show a growth in the time required for loading and unloading, but there is some doubt as to the reliability of these data.

²¹ The year 1933 was, however, a poor one for heavy industry. The marked renewed rise in heavy industrial output occurred in the following year.

²² Hunter, *Soviet Transportation*, pp. 59-60.

ever, this approach runs the risk of understatement. Many types of industry lack ample or expandable storage prior to transportation in the Soviet economy as in others. It would be interesting to know whether any stoppage of production or slowing down of production occurred in consequence and to appraise its significance. There is some evidence pointing in this direction, though a quantitative analysis is impossible from the data at hand. It is apparent, however, that the shortage of transport was taken extremely seriously at top government levels in the Soviet Union. It is also apparent that the measures taken were highly effective since they were applied to a rail system which for some time had been laboring close to the limits of its capacity.

The year 1934, if the statistics are to be believed, saw an increase in tons originated which had been equaled only once before—in the increase of 1930 over 1929—while the average haul resumed its increase. In consequence, operating ton-kilometers increased by 23 per cent, building upon the recovery of the late months of the preceding year. Sharp improvements in the operating indexes occurred and appear to bear the major responsibility for improved traffic performance at this stage of the crisis. In 1934 the Soviet railroads, according to the statistical record, tightened their operating performance, and it is clear that the shipping ministries, goaded by officials from Stalin on down, cooperated in a more effective fashion. Although unshipped backlogs remained at the end of 1934, the crisis was in good part broken before significant relief could be secured from increased materials allocations and their embodiment in additional line and yard capacity, motive power, and cars.²³ Thus average static carload increased 8.7 per cent in one year²⁴ and car turnaround time decreased by 8.5 per cent.²⁵ Locomotive-kilometers per active freight locomotive-day showed a modest increase and reached a new high. And average freight trainload increased significantly. Unhappily it is impossible—in the light of the statistical deceptions known to be inherent in the reporting system of the Soviet railroads, known changes in reporting concepts at various times, and the general looseness of statistical con-

²³ As noted below, there is evidence of some increase in equipment in 1934 which should have been of assistance to the operating authorities in the latter part of the year.

²⁴ Static carload represents the tonnage loaded in the average two-axle unit and is computed by dividing tons originated by carloadings (in two-axle units). It should not be confused with dynamic carload, which is computed by dividing net ton-kilometers by loaded car-kilometers. The use of tariff ton-kilometers for computing this will tend to show it in a poorer light than was actually true.

²⁵ That the official data somewhat overstate the improved turnaround can be argued from the data in Appendix A.

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trol—to assess the degree to which performance actually improved in the year in question as a result of efforts to cope with the crisis.²⁶ It is probable that the improvement was less startling than that on record. Doubtless heavier maintenance expenditures beginning in 1933 must have contributed to these results, although it has not been possible to pin down the evidence. Expansion in the numbers of operating personnel is, however, apparent. These events may indicate that the system had margin for improvement despite its apparently hard-pressed condition in 1933, but the exact extent of improvement actually achieved remains unknown.

Nevertheless it is clear from Hunter's analysis that investment in the railroad sector had lagged and that an 18 per cent cut was imposed in 1933 at a moment when the shortage of transport and its potential effects should have been clearly apparent.²⁷ Though congestion appears to have been alleviated in large part by tightening performance, growth could only be resumed by rectifying the proportions of investment between transport and other industry. Without detailed analysis of the impact of an enlarged railroad program by shape and form breakdown and by component capacities, it is impossible to say whether increased allocations could have been made for the required rail items without imposing serious delay upon the heavy industry program. In 1934 and 1935 more favorable treatment was accorded the railways, but thereafter, as the crisis was regarded as solved, much emphasis was again placed upon tightening performance in order to cope with steadily growing traffic, and performance factors generally improved into 1937.

The year 1935 provides one of those interesting anomalies in the official Soviet account of events. Although performance had been improved in 1934, backlogs of unshipped freight had been reduced either by movement or by local absorption, and an expansion of plant and equipment through increased investment was already under way, delayed reaction to the "crisis" resulted in the discredit of the railway administration and the appointment of Lazar Kaganovich on February 28, 1935, as Minister of Transportation. The tenor of the official view of the magic worked by his administration is indicated in Appendix A.²⁸ Analysis of the available data for 1935, however, tentatively

²⁶ No definite evidence of statistical manipulation or changes in the basis of reporting appears during these critical years, although there are known changes in the basis of reporting certain data in other years. The concept of active locomotive fleet, which has changed, appears to have remained stable in these years.

²⁷ See Hunter, *Soviet Transportation*, p. 71.

²⁸ See also *ibid.*, pp. 74-80.

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suggests a considerable deception in the Soviet figures, particularly in the calculated average car turnaround. For it appears probable that the increase of freight cars in the fleet under railroad jurisdiction was slightly understated in 1934 and considerably understated in 1935. The understatement of the increase in the active or working fleet may have been greater. Such an understatement of course makes the car turnaround appear to have improved much more than may actually have been the case. A series of calculations in Appendix A tentatively assigns 69 per cent of the increased carloadings of 1935 to the increase in the active freight car fleet and the remainder to an improvement in car turnaround.

It is notable that there was a significant increase in the production of new locomotives in 1934 and a still greater one in 1935. Furthermore, the FD type, which is the heaviest class of freight power in common use on the Soviet railways and which has approximately 10 per cent more tractive effort than class E, began to be produced in great quantity in 1934 and represented slightly over one-third of 1935 production. Apart from their increased drawbar power, these locomotives were also given larger driving wheels and more ample boilers, and hence were capable of higher speeds in road service. The acquirement of such a considerable number as 1,123 heavy freight locomotives in 1935 must have contributed to the faster clearance of yards and improved road speed. Their concentration on the heavy traffic lines, which may be presumed to have suffered the greatest congestion, must have had a more beneficial effect than can be traced through the system averages. The base was laid in 1935 for the improved performance of the two subsequent years, and it is noteworthy that locomotive building remained 50 per cent above the 1932 level right through 1938. Such evidence as we have suggests that improved traffic performance should be attributed more to improvement of plant and equipment than to any administrative legerdemain, despite the emphasis placed on the latter in the Soviet literature.

The year 1938, however, saw a slight fall in carloadings and in tons originated despite an increase in average carload. Revenue ton-kilometers continued to grow as a result of increasing average haul, but car turnaround was notably slower and to a degree which cannot be accounted for by the increase in average haul alone. On the average, shippers required two hours more for loading and unloading than in the previous year, which had represented an all-time record for effective car handling; but the increase of delay in classification

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yards was more serious in its effects upon turnaround time.²⁹ Empty car-mileage again increased, but probably not for the same reasons as in 1933. Inasmuch as line-haul movement seems to have been well maintained, it is to the deterioration of work in classification yards, as well as to the slower working of cars by shippers, that we must look for an explanation of diminished loading capacity. No satisfactory explanation appears, but the data bear the earmarks of lagging demand for transportation. Railroads generally perform better under the pressure of a traffic demand in excess of capacity to haul, other things being equal, and utilization will necessarily fall if the pressure diminishes. The rate of growth of Soviet production, it appears, was showing a tendency to slow down, and there may have been less severe pressure on car turnaround.

The composition of traffic underwent interesting changes. While coal, coke, petroleum, firewood, and grain originations increased, the traffic in ores and in iron and steel and timber declined. Allowing for the shift of a large tonnage out of the other freight category into mineral building materials, it would appear that other freight suffered a minor decline. The nature of these shifts would not suggest a shortage of transportation capacity. Moreover, the monthly loading data make clear that the modest decline in originations was well spread through the spring and summer months. Somewhat of a recovery appears to have begun in the fall and may conceivably have been affected by relatively heavy grain movements.

Recovery in 1939 was marked, with a growth of approximately 8 per cent in tonnage originated and a smaller growth in ton-kilometers because of a slight reduction in length of haul. Car turnaround improved, but the more liberal supply of cars made it unnecessary to achieve the very rapid movement of 1936 and 1937. Shippers' handling of cars appeared to have established a new record and the movement of cars through classification yards was fully restored to its earlier level. Trainload, train speed, and average kilometers per active locomotive-day all increased somewhat. There appears to be an unexplained inconsistency in the Soviet data, however, for while train speed increased and the average turnaround trip of a freight car declined slightly, more time is reported to have been taken by the average car in motion between terminals.³⁰ Further improvement occurred in 1940, with approximately the same increase in tonnage originated. It would appear, therefore, that on the eve of the war the Soviet

²⁹ See *ibid.*, Table 76, p. 409.

³⁰ See series C-31 in Appendix C and compare with Hunter, *Soviet Transportation*, Table 76, p. 409.

railroads were in a strong position with adequate capacity for the demands made up to that time, with a remarkably liquid freight movement, and with well-developed techniques for handling mass freight transportation under difficult weather conditions as well as under favorable circumstances. The actual state of the railroads contrasted strongly with the low esteem in which they were generally held in the Western world.

Freight Traffic Performance in War

The Soviet railway system manifestly proved adequate to support massive and effective military operations. The means by which this success can be judged are meager, for information on the war period is largely lacking. As related to Soviet economic growth, the events of the war years in terms of actual traffic and operating performance are of limited significance. The losses sustained, the recovery therefrom, the influence of foreign assistance, and the test afforded of operating practices are not, however, without importance. In appraising them, it is particularly necessary to bear in mind that the conditions encountered in the Soviet Union differed very sharply from those in the United States and Great Britain, and even more sharply from those in the area of Greater Germany. For the Soviet system contracted and the wartime requirements developed on an industrial base which was already operating in nearly as high a gear as possible. Not only did the rail system contract with the loss of territory, but the industrial base was also reduced by the loss of the intensively developed Donbas, and the lines of communication to the armed forces were substantially shortened for a significant portion of their requirements. Hence the history of Russian wartime rail transport is altogether different from that of the German rail system during the same period.

Soviet prewar opinion, as reflected in a number of the writings which no doubt had been influenced by the "transportation crisis" and by the experience of the first war, tended to forecast serious transportation difficulties in the event of war. There was, however, considerable prewar strengthening of the rail net by new construction and its continuation during the war by the completion of lines of strategic importance, particularly in support of Leningrad and Stalingrad, and of lines necessary to the expanding trans-Ural industrial base and the opening up of alternative resources.³¹ There was, moreover, the noteworthy wartime "compression" of operations, to use Hunter's

³¹ Hunter, *Soviet Transportation*, Chapter 5.

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term: the decline of operated first main track from 95,526 kilometers³² in 1940 to 69,000 in 1942, the loss including the heavy-density network of the Donbas, and the quite successful withdrawal of motive power and rolling stock from the areas which came under German occupation. This, of course, considerably increased the density of power and car stock per kilometer of line for the remainder of the system and created a surplus where tightness had been the historical experience. The wartime traffic pattern, on the basis of the slim evidence available, shows a relatively small direct military component and a decline in total traffic considerably greater than the reduction of line operated. This apparent Soviet experience checks with our own in the two wars. It is, moreover, of large importance that the bulk of the lines lost were in the heavy-density areas which, in the Soviet economy, compare with our northeast, while the lines remaining in the operating system more nearly resemble our light-density western lines.³³ Hence system traffic density declined, although many important routes carried much heavier traffic than previously, and required work in the way of construction of auxiliary track to increase line capacity and the capacity of yards and terminals. This phenomenon had something of a parallel in the U.S. transcontinental routes because of the wartime growth of west coast industry and the supply demands of the Pacific theatre.

Of the factors explaining the comparatively satisfactory wartime performance of the Soviet rail system, the most important, of course, is the contraction of the system and of the area served with the resulting surplus of power and equipment. Yet it is important to note that the great rollback of the German armies and the invasion of Germany itself was adequately supported by a rail system which had to reconstruct before it could operate in the recovered territory. As Hunter emphasizes, however, the reconstruction was of lines required to service the advancing armies as supply routes. Reconstruction for economic purposes followed, as the rehabilitation of the occupied areas got under way and was spread over a considerable period of time.³⁴

³² Hunter's figure, which is the annual average. See series C-35 in Appendix C where the kilometrage for the expanded territory is given as 106,102 at the end of 1940.

³³ Garbutt estimates that the lines in occupied territory handled 40 per cent of prewar Soviet traffic (P. E. Garbutt, *The Russian Railways*, London, 1949, p. 22). It appears quite possible that this is an understatement of the facts.

³⁴ See Hunter, *Soviet Transportation*, pp. 102-104. The complaints of the Soviet military, notwithstanding an apparently outstanding performance of the rail authorities, are noted in Raymond L. Garthoff, *Soviet Military Doctrine*, Glencoe, Ill., 1953, note 40. Carloadings grew approximately 20 per cent in 1944, but only 11 per cent in 1945. It was not until 1949 that the prewar level of carloadings was reached and passed.

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The statistical record of the war years is highly incomplete, hence less can be learned of railroad operations than for prewar and postwar years. The discussion which follows is offered not because the war years shed any particular light on Soviet economic growth over the long term, but rather because the ability to get through the war successfully speaks well for the Soviet railroads, while the vast problem of reconstruction which stood in the way of postwar recovery cannot be understood without devoting some attention to the contraction and destruction of the system.

The more intense working of the easterly lines of the Soviet system required an increase in their capacity, as noted above, through the construction of additional trackage and the improvement of signaling and operating procedures. For a time, motive power and cars should have presented no difficulty except for finding ample track storage for surplus equipment. As the system's manufacturing and heavy repair facilities had also been located on the lines which were now occupied, even the ability to provide new equipment was temporarily lost, and the surplus had to be traded on by increasing the bad-order ratio³⁵ and, in time, cannibalizing unserviceable equipment. Shops were, however, expanded on the eastern lines and the notable works at Krasnoyarsk apparently were established by the evacuation of older plants from the west.

Deliveries under U.S. Lend-Lease provide a clue to the problems faced by the Soviet lines both in maintaining themselves in the later stages of the war and in launching the westward extension of military supply lines. These deliveries included sizable quantities of rail, frogs and switches, block signal equipment (including the first centralized traffic control panels and circuits used in the Soviet Union), portable electric generating plants carried on railway cars, car wheels and axles, air brake sets and other car specialties, and some 1,800 standard steam locomotives (largely of the Decapod 2-10-0 type similar in capacity and general features to the locomotives built for Imperial Russia during the first war, but equipped with certain modern specialties and generally more satisfactory from a maintenance point of view), plus a few electric and diesel units.

Brief consideration will make clear the need for these items. A good part of Soviet capacity to roll rail had been lost. Considerable quantities of material were needed to be able to lay yard and side track, to carry out certain important line extensions, and to add second main running track at points of congestion. Block signaling equipment was

³⁵ The ratio of unserviceable cars to the total number of cars.

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badly needed in order to increase the capacity of lines which had become congested by an unwonted flow of traffic. Centralized traffic control served the same purpose, but the amount exported could only provide a token installation on some selected segment of line. Certain steel imports of standard shapes and forms may have provided some underframe material for freight cars. Wood, a relatively abundant commodity in the USSR, is heavily used for flooring and sheathing many types of Soviet freight car. Indeed it may be said that the composite car is still standard Soviet practice although it has seldom been built in the United States since the middle 1920's.³⁶ Hence the principal steel items required for new cars and heavy rebuilds would have been underframes, wheels and axles, truck side frames³⁷ and bolsters, couplers, and other specialties. Of these, Lend-Lease provided considerable quantities. Both the assembly of new and the heavy repair of old cars can be carried out in the open at any suitable site and with a minimum of equipment. The supply of specialty components and of heavy steel shapes for the underframe is the principal limitation.

The locomotives supplied under Lend-Lease were undoubtedly important in maintaining an ample supply. They were basically similar to the light Decapods which had been extensively used in Russian heavy freight service for a number of years. Simple and rugged in design with relatively light moving parts, they were easy to maintain with a minimum of back shop equipment³⁸ and a labor force of small mechanical skill. Moreover, even under Soviet conditions, they should have been good for two or three years of service without heavy repair. The testimony of one U.S. Transportation Corps mission which had the opportunity to observe briefly rail operations behind the Soviet lines indicates that the working stock was in part maintained by ditching locomotives requiring heavy repair and replacing them with new imported power.³⁹ The unserviceable locomotives could then be

³⁶ During the second war composite gondolas and hoppers were built in the U.S. because of the shortage of steel plate. No box cars were permitted to be built at that time.

³⁷ Considerable use was still made of arch bar frames which could be fabricated from small steel shapes.

³⁸ The phrase "back shop" refers to heavy repair facilities generally connected with engine houses and widely distributed over the road.

³⁹ Motor trucks, which were provided under Lend-Lease in very large numbers, appear to have been used in the same way and played a significant part in military supply operations. It appears that in the late phases of the war, Soviet forces operated at times from 200 to 400 miles in advance of railhead. Living off the country, they depended at times upon trucks for ammunition and fuel. Nevertheless, major rail supply lines underwent remarkably rapid restoration and often paced the movements of the front, resulting in the arrival of supply trains at points still being fought over or under fire.

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cannibalized to repair others. It is no doubt significant for an appraisal of the Soviet shop position that, whereas components of freight cars were imported, the demand in motive power was for complete assembled locomotives shipped with the main rods down but otherwise ready to run.

Soviet operating practices were well adapted to placing a heavy traffic load on available railroad lines. Their prewar passenger timetable showed a small volume of main-line intercity service. Even on relatively important lines, only a few daily trains were scheduled and the heaviest of such workings were in the territories now occupied by the enemy. Under the exigencies of war, it may also be presumed that little effort was made to hold to booked times when the pressure of freight traffic was severe. And as fast passenger service was virtually unknown, so also was fast freight service. Hence the sharp reduction of line capacity occasioned by having one or more fast preferred trains on the line was avoided. The slow pace of movement also permitted relatively close headway, and where electric staff proved inadequate for the press of traffic and block signaling was unavailable, a manual block could be improvised by hand signaling. Where line capacity governed, a relatively even dispatchment of trains could be arranged over the twenty-four hours. It is unwise to apply conclusions drawn from Western experience to such basically different conditions.

In the movement westward, involving extension of the lines supplying the armed forces, the contrast with Western methods was sharply apparent and in part explains our wartime inability to believe that the advancing Soviet armies were adequately supplied. It is first to be noted that the daily supply requirement of a Soviet division was substantially under the tonnage required by its Western counterpart and that irregularities of supply, particularly of food, were accepted.⁴⁰ But the most striking differences are in the methods by which a limited open rail network was turned to account. Again the U.S. Transportation Corps mission sheds some light. Where possible a single-track line would be paired with another lying cross-country, each line being operated in a single direction, giving the effect of a double track. Elsewhere on single tracks, groups of trains were sent in one direction during a portion of the day in order to eliminate meets.⁴¹ Of the

⁴⁰ A most interesting, though brief, account of Soviet logistics is given in Garthoff, *Soviet Military Doctrine*, pp. 290-294. The whole system of supply appears to have been as haphazard as the rail movements up to railhead, and the notion of orderly stocks at specified levels and in particular relationship to the front appears to have been lacking.

⁴¹ Both of these methods have been employed elsewhere, but on a more limited scale.

greatest importance, forward depots with extensive rail trackage, yards, and sidings were hardly required. For the Soviet technique was to supply enough labor, conscripted from the countryside if need be, to unload a full train simultaneously and at a fast rate. Hence it was unnecessary either to break up trains at railhead or to provide extensive trackage to hold cars, and the use of equipment was maximized.⁴² It is clear that Soviet railroad men had both skill and a spirit of improvisation and their long training in high-pressure operations in peacetime undoubtedly stood them in good stead. Their skill in restoring destroyed or damaged trackage, bridges, etc., is discussed elsewhere.⁴³

Reverting, however, to operations in the unoccupied areas, some confirmation of the general pattern of performance can be gleaned from the operating statistics. Carloadings and tonnage originated had reached peaks in 1940, influenced somewhat by territorial acquisitions.⁴⁴ Both declined in 1941, but a sharp contraction to the wartime low was marked in 1942 when carloadings stood at 43 per cent of the 1940 high. Tonnage originated fell less rapidly, for there was a marked increase in the average load per two-axle unit from 16.6 tons in 1940 to 18.6 tons in 1942, and this increase continued the following year.⁴⁵ The contraction of operations to the east where the population was less dense and distances greater was reflected in an increase in average haul, although this was less noteworthy than might have been expected, from 700 kilometers in 1940 to 786 in 1942.⁴⁶ Hence the fall in ton-kilometers was considerably less than that in carloadings. The abundance of freight car equipment is confirmed by the decline

⁴² Of all measures rare in Western practice, this was undoubtedly the one of most importance.

⁴³ See Hunter, *Soviet Transportation*, Chapter 5. Garbutt (*Russian Railways*, p. 24) cites Soviet claims that the bridge over the Dnieper at Kiev, 1,100 meters long, was replaced with a temporary structure in thirteen days and that a larger structure was completed at Dnepropetrovsk in twenty-two days. Single-track working was required for some time over the greater part of the restored system and the replacement of temporary structures was spread over a considerable period of time. On the other hand, a Soviet military complaint is recorded to the effect that restoration progressed at a tempo hardly faster than during the first war, although track restoration up to twenty kilometers per day and more is recorded (see Garthoff, *Soviet Military Doctrine*, p. 292). The Soviet press, notably *Zheleznodorozhnyi transport* [Railroad Transportation] (issues of 1944 and 1945), contains detailed accounts of very creditable performance in the face of heavy destruction by the retreating enemy. Very heavy forces were evidently employed to secure the simultaneous reconstruction of a large aggregate mileage.

⁴⁴ It should be observed that the eastern Polish lines acquired by the Soviet Union represented the light-density portion of the Polish system.

⁴⁵ See series C-2, C-4, and C-5 in Appendix C.

⁴⁶ Further increases are estimated to have occurred in the following year, but a decline appears to have been encountered in 1944 (see series C-3).

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in car-kilometers per active freight car-day from 139.9 in 1940 to 94.6 in 1942, while the average turnaround time grew from 7.37 days to 13.8 days. The proposition that the trans-Ural industrial complex required excessive empty car movements to balance equipment in the face of unbalanced commodity flows is perhaps confirmed by the rapid growth of empty car-kilometrage per freight car turnaround from 300 kilometers in 1940 to 385 in 1942 and 439 in 1943, although other interpretations can be supplied to account in part for this phenomenon.⁴⁷ These operating statistics should not be viewed as the result of a deterioration, much less of a breakdown, in Soviet rail performance. They are the natural result of a surplus of equipment, congestion of lines and terminals, and the slackening of effort in loading and unloading which an abundance of cars makes possible. It would appear that an expeditious adjustment had been made to sharply changed conditions, aided in due course by the importation of supplies from the West through the three primary gateways in the rail system.

During the movement westward in 1943-45 the growth of operated line was rapid, although much of the restoration was temporary and did not include normal facilities for commercial traffic. Freight traffic grew less rapidly than operated line, as is apparent from the percentage relationships in Table 8.

TABLE 8
SOVIET FREIGHT TRAFFIC, 1942-45
(per cent of 1942)

	Kilometers of Line	Average Daily Carloadings	Tons Originated	Tariff Ton- Kilometers
1943	129	107	109	113
1944	176	130 ^a	128 ^{a, b}	131 ^b
1945	179	145 ^a	137 ^a	138

SOURCE: Series C-34, C-4, C-2, and C-1 in Appendix C.

^a Average carload declined after 1943 and approximated the 1941 level in 1945.

^b Average haul declined in 1945 and appears to have declined in 1944. In the earlier year it still stood some 13 per cent above the prewar level.

It is well again to caution the reader that the material upon which estimated operating and traffic data for the war years are based is highly fragmentary. Nonetheless it is reasonably apparent that the rapid restoration of first main track in liberated territory was not matched by increase in traffic, particularly because the economy of

⁴⁷ See series C-33.

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these areas was prostrate and large-scale economic reconstruction could not get under way during the massive drive to the west.

Postwar Developments

Little expansion appears to have occurred in the postwar period, for the 1953 network exceeded that of 1945 only by 7,000 kilometers (see series C-35). Postwar reconstruction was devoted to restoring the capacity of the reacquired network and subsequent efforts have been in intensive development, such as improved signaling, lengthened sidings, enlarged yards, the partial mechanization of yards, and additional multiple tracking at certain bottleneck points. Indeed the intensive development of the system since 1949 has been startling in its effect. Whereas freight traffic density (ton-kilometers per kilometer of road operated) more than doubled between 1933 and 1939, it now increased by another 60 per cent in a brief six-year period (see series C-36). The data in Table 9 show in summary form the return to prewar traffic density and the subsequent expansion. A railroad system

TABLE 9
SOVIET FREIGHT TRAFFIC DENSITY, 1939, 1945-54
(thousand ton-kilometers per kilometer of line)

Prewar		Reconstruction		Postwar ^a	
1939	4,570	1945	2,809	1950	5,170
		1946	2,952	1951	5,774
		1947	3,053	1952	6,272
		1948	3,855	1953	6,689
Prewar attained		1949	4,519	1954	7,134

SOURCE: Series C-36 in Appendix C.

^a The period bears some resemblance to the intensive development of the U.S. system during 1904-14, a matter which will be discussed further. But such comparisons should be approached with great caution.

faced with this type of situation must pursue a course of development quite different from the one it would follow if it were growing largely out of the conquest of new territory and the channeling of increased density in the older areas over a few highly developed trunk lines.

Following 1946, operating ton-kilometers grew at an annual pace of 80 billion until 1952 when the increase was about 60 billion, a figure which was approximated in each of the following two years. Not only has growth not ceased, but the increase in operating ton-kilometers was somewhat greater in 1954 than in the preceding year, and in 1955 the annual increase moved above 100 billion. As these are estimated

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by extrapolation of the divergence from tariff ton-kilometers which is believed to be diminishing during recent years, the increase in tariff ton-kilometers has been somewhat less, although it has followed the same general pattern. Average length of haul reached a low of 712 kilometers in 1949, compared with 700 on the eve of war, and has since gradually increased, as far as it is possible to estimate from available data, reaching 757 kilometers in 1954 and 815 in 1957. The latter level has been approximately maintained. In consequence, the growth of tonnage originated has been slightly slower than that of ton-kilometrage. Average carload (per two-axle unit), which declined from the wartime level during the earlier restoration period, has since been increasing and reached 19.8 tons in 1954;⁴⁸ by 1960 it reached 21.5 tons. Hence growing traffic has not required an equivalent increase in carloadings for its accommodation.⁴⁹ Moreover, car turn-around has improved every year since 1942 with the exception of 1954 and 1956; by 1953 it surpassed the best record of the late 1930's, and since then has been superior to any prewar performance. The 1959 datum represented a new record of 5.72 days.

While way and structures have undergone intensive development, motive power and rolling stock have necessarily been increased in numbers and the principal investments in railroads have gone into these items. Although we have no direct data on the numbers of locomotives or of cars owned or in service since 1940, the active fleets can be calculated directly from the operating statistics. The active freight car fleet reached a low of 576,000 two-axle units in 1943. The 1940 level of 721,200 units was exceeded in 1947 and since that time growth has averaged 40,000 two-axle units per annum (see series C-26). The aggregate carrying capacity of the active fleet would appear today to be approximately double that of 1940 whereas the operating ton-kilometers have multiplied by two and a third. Not only has the earlier level of efficiency in car handling been regained—it has been substantially surpassed, and the required investment in rolling stock

⁴⁸ It is of more than passing interest that average carload had increased 18.5 per cent since 1940, whereas the average capacity had increased but 15 per cent. Another difference thus appears between the Soviet position and that of Western countries where commercial practices tend to limit the advantage obtained from increased unit capacity. The static load of 19.8 tons compares exceptionally favorably with the average capacity of 24.1 tons in 1954. All of these data are in two-axle units.

⁴⁹ The qualification noted in discussing Soviet weight of lading practices should be recalled. It is always possible that apparent trends in average load are the result not of heavier actual loading but of an increase in the overstatement of loading.

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accordingly limited.⁵⁰ Yet we have no substantial evidence that the pressure is excessive or that any significant shortage of rail capacity has developed, although there have been warnings that such shortages might again occur. If the exceptionally intensive utilization of all elements of the rail plant in the late 1930's requires explanation, then that of the period since 1950 is even more in need of explanation. In part this will be accomplished through a subsequent study of the operating statistics. But in part the explanation is to be found in conditions extraneous to railroad operation and in policies established for the governance of shippers and carriers alike. Attention will be focused in Chapter 3 upon factors which affect the traffic—its volume, composition, flow, and periodicity as a prelude to the discussion of the operating statistics in Chapter 4. For the traffic conditions which Soviet railroads face are fundamentally different from those which prevail in Western countries.

Railroad Passenger Traffic

Passenger operations have an effect upon the freight capacity of a rail system and it is for this reason that a brief examination of these operations seems useful. Not only has the automobile remained unavailable on any considerable scale, but very little intercity motor bus service has been developed, except as a very minor feeder to the rail lines and as a token service between a few of the larger cities in the west. While progress has been made in commercial aviation, the airplane has not become a mass carrier of passengers but serves largely priority purposes on a limited scale and is of major significance only on the long routes. Hence the railroad remains the principal means of passenger transport save where steamer lines are available on certain of the larger watercourses and in coastal waters.⁵¹

Because of this primary reliance upon railroads, Soviet rail passenger traffic is large and its density over the thin route network of the Soviet rail system is heavy. In comparison with the size of the country and its population, however, even this large traffic suggests a relatively immobile people.⁵² Moreover, as will become apparent, by far the

⁵⁰ The possibility of increasing deception in the data along the lines discussed earlier must always be borne in mind, but it appears to us improbable that the position relative to earlier years is materially overstated.

⁵¹ A sixfold expansion of air passenger mileage by 1965 is planned which would bring air passenger volume to some 20 billion passenger-miles and extend substantial relief to rail long-haul passenger services.

⁵² If the large use of the private automobile in the United States, which for many years has accounted for more than 85 per cent of the intercity passenger movement,

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larger part of Soviet rail travel is short-haul commutation service around the large metropolitan areas where the railroads serve more nearly in the fashion of the British and Continental railroads than like those in the United States, i.e., much that is done by automobile or bus in this country is a steam railroad job in the Soviet Union and in other countries.

Soviet passenger traffic stood at a low level in 1921/22, less than half the prewar volume. Not until 1929 were the 1913 passenger-kilometers surpassed. The restoration of freight traffic came first and comparatively little was provided in the way of passenger train accommodations, although trains were restored to punctuality, efforts were made to clean up the equipment, and certain dining car services were resumed, the latter largely for the effect upon morale. After 1923/24, the average length of passenger trip remained quite steady. Between 1923/24 and 1929 long-distance passenger traffic grew slightly more than suburban traffic, although the latter stood in 1929 at approximately two and a third times the volume of 1923/24 (see series C-12 and C-15).

The early 1930's saw a remarkable growth in passenger travel. Between 1929 and 1932 long-distance traffic more than doubled, while suburban traffic came close to quadrupling. The relationship of this growth to urbanization will be apparent. Soviet passenger traffic in 1930 surpassed that of Class I railroads of the United States for the first time, and by 1931 it had exceeded the all-time high of American rail passenger traffic, which had been attained in 1923. The U.S. roads, under the influence of the automobile and the bus, had had steadily declining passenger traffic since that year and the rate of decline increased after the fall of 1929. It is of interest to note that Soviet commutation traffic in 1930 was approximately equal to that in the United States, but thereafter shot up rapidly while the U.S. traffic declined.

The years 1933-36 were marked by a lower level of passenger traffic, and the 1932 level was not attained again until 1937. The decline was almost entirely in long-distance traffic, for commutation traffic held quite steady during these years and showed some growth in 1936.

is ignored, we must reckon some 117 billion annual passenger-kilometers in recent years by the three principal modes of intercity commercial passenger transport, whereas the Soviet rail traffic is believed to have approximated 107 billion passenger-kilometers in 1952, for a population one-fifth larger than the American one. By 1959 the Soviet passenger-kilometers had grown to 164.4 billion by rail and approximately 170 billion by all forms of transport. Per capita use of mass transport would thus appear to have run above current figures for the U.S.

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This performance is probably related to the development of the transportation crisis of the 1930's, for the priority necessary for freight service and the general shortage of line capacity no doubt prevented an increase in passenger service, which under other circumstances might have been undertaken. Indeed it appears that long-distance passenger services were curtailed in the interest of relieving freight congestion.

Soviet passenger service has, however, never been the embarrassment to freight service that is characteristic of competitive service elsewhere. As the timetables reveal, the service is infrequent, the majority of trains are local or accommodation trains, and booked speeds are low.⁵³ While rail passenger service is a necessity, there is no competitive stimulus to produce a multiplicity of lightly loaded fast trains nor is there occasion for the duplication of train service. The passenger service appears to be arranged more for the operating convenience of the railroad than for the convenience of the passenger. Few trains approach 30 m.p.h. in their speed, and only between Moscow and Leningrad is something approaching an express passenger service operated.⁵⁴ Over most lines a very limited number of heavy slow trains operate, affording minimum interference to the freight traffic which is accorded primary importance.

Between 1936 and the beginning of the war, the growth of passenger traffic was resumed, but at a moderate rate. From 90.9 billion passenger-kilometers in 1937, a prewar peak of 98.0 billion was achieved in 1940, but much of the increase must be attributed to enlargement of the rail system by territorial acquisition. Approximately half the total growth in these years was accounted for by the expansion of suburban traffic. Soviet long-distance traffic within the old territorial limits can hardly have grown significantly. At the end of the period, however, commutation traffic stood at 2.4 times the maximum volume ever attained in the United States. The average trip in commutation service has remained remarkably steady and is approximately the same as the U.S. figure. It would appear that an excellent job is done in handling intensive commuter loads although the standards of comfort and crowding leave much to be desired.

⁵³ The latest timetables to reach the United States are for 1959. See *Ukazatel' zheleznodorozhnykh passazhirskikh soobshchenii leto 1959 goda* [Railroad Passenger Timetables for the Summer of 1959], Moscow, 1959.

⁵⁴ Hunter, *Soviet Transportation*, Chapter 10, affords some comparison of various routes and years which are representative of the better long-distance services. It is recently reported that the Moscow-Leningrad service has been accelerated to six hours and twenty minutes, requiring an average speed of 63.7 m.p.h. (*Trains*, June 1961, p. 30).

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The war years in passenger traffic, as in much else, are a blank. The 1945 volume, however, stood at approximately two-thirds that of 1940, the decline having been about the same in the suburban and long-distance services. The volume in 1946 approached the 1940 volume, apparently as the result of nonrecurring mass movements which affected primarily the long-distance services, although a bit of a bulge is also observable in the commuter traffic and the latter did not attain the prewar level until 1951. Schedule timings were, however, much slower than in prewar years and, although improved, remained inferior as late as 1949. A slight decline in total passenger travel for 1947 was followed by a precipitate decline in 1948. A return to the prewar level was achieved in 1951 and a steady, but moderate, increase occurred during subsequent years. The Soviet railways are, no doubt, now the largest passenger-carrying system in the world, having surpassed the British, while the German system has been cut in two parts. In number of passengers carried, the Soviet system still falls below the prewar German system, but its average haul in the long-distance services far exceeds the German performance. At present there is much to indicate progress in improving the quality of passenger service—transition to the all-steel car, improvement of appointments in the coaching stock and acceleration of certain services.

The selected data in Table 10 illustrate the position in recent years.

TABLE 10
SOVIET PASSENGER TRAFFIC, 1949-57

	<i>Thousand Passengers</i>		<i>Million Passenger-Kilometers</i>	
	Long-Distance	Suburban	Long-Distance	Suburban
1949	202,500	877,600	61,400	19,900
1951	214,300	1,101,000	73,400	25,100
1953	229,300	1,275,000	89,400	28,900
1955	249,400	1,392,000	109,100	32,300
1957	248,000	1,506,000	118,700	34,700

SOURCE: Series C-12, C-13, C-15, and C-16.

It will be noted that the number of long-distance passengers had declined from the 340.4 million reached in 1940. Nor had the level returned to that of 1945 as late as 1959. Nevertheless, passenger-kilometers in the long-distance service increased and by 1951 exceeded the prewar level. The average trip of long-distance passengers grew from 303 to 479 kilometers in the period covered by the table and thus stands some 120 per cent above the prewar datum. The restrained growth of long-distance trips in recent years is no doubt traceable in

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part to the gradual shift of official and business travel to the airline services, although nothing approaching in volume the comparable shift in the United States has yet occurred.

No factor is of greater importance in permitting the development of a very large passenger business with a limited train mileage than the lack of standards of public service and the absence of any competitive pressure, which permit a load factor far in excess of anything achieved in Western countries and avoid the necessity of operating train services that the available volume of traffic will not justify. For in the Soviet system traffic is allowed to press upon the service and, whereas in the United States passenger load factors⁵⁵ are not much above 25 per cent for the service as a whole, the Soviet factors must be supposed to lie in the 80's if not higher for the long-distance services. On an equivalent load factor the train service operated in the United States might be expected to handle three times the present passenger-mileage and roughly this expansion occurred during the latter part of the war. To the load factor may be added the tendency to move the bulk of the traffic in cars equipped with wooden benches and arranged for high-seating density, the infrequency of the train service, and the heavy trainloads. If the Soviet freight service is reminiscent of American conditions in the first quarter of the present century, the passenger service recalls that of Western European countries during the same period minus the fast express services.⁵⁶ Few operating data are, however, available and further analysis would be relatively unproductive.

⁵⁵ Passenger-miles as a percentage of seat-miles operated.

⁵⁶ Load factors may, indeed, be higher than suggested above. Moreover, it seems probable that, at least in the first postwar decade, the volume of passenger traffic was restrained by the limitation of service. Edward Crankshaw notes that, "For years it was impossible, without the necessary *blat*, to get a railway ticket from Kiev to Kharkov," and he defines *blat* as a "peculiarly Russian mixture of spivvery and graft" (*Khrushchev's Russia*, Baltimore, 1959, p. 73). The recent U.S. railway mission to Russia reports that "they permit passengers to ride on top of trains, even in electrified territory with catenary, and through tunnels" (*Railway Age*, August 1960, p. 14). The same group reports that people wait in stations for perhaps two days at a time during peak travel seasons trying to board a train (*Traffic World*, August 6, 1960).