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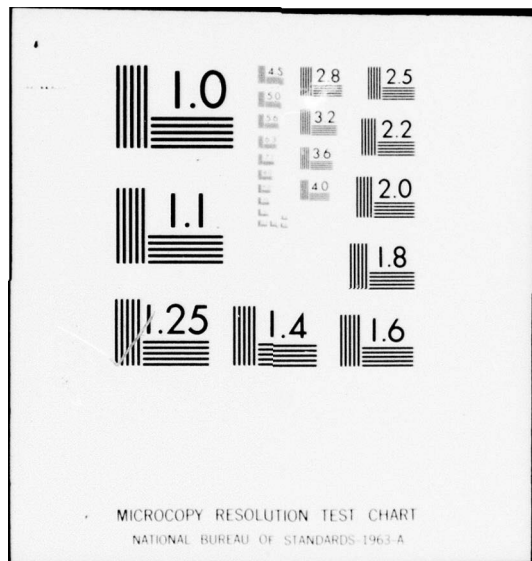
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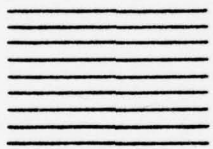
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US ARMY INSTITUTE FOR ADVANCED RUSSIAN AND EAST EUROPEAN STUDIES



STUDENT RESEARCH REPORT

MAJ. Franklin H. Ferguson
AN ANALYSIS OF THE PRESENT DAY MILITARY
SIGNIFICANCE AND STRATEGIC VULNERABILITY
OF THE SOVIET RAILWAY SYSTEM IN 1975

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F O R E W O R D

This research project represents fulfillment of a student requirement for successful completion of the overseas phase of training of the Department of the Army's Foreign Area Officer Program (Russian).

Only unclassified sources are used in producing the research paper. The opinions, value judgments and conclusions expressed are those of the author and in no way reflect official policy of the United States Government; Department of Defense; Department of the Army; Department of the Army, Office of the Assistant Chief of Staff of Intelligence; or the United States Army Institute for Advanced Russian and East European Studies.

Interested readers are invited to send their comments to the Commander of the Institute.


RICHARD P. KELLY
LTC, MI
Commander

 SUMMARY

In this paper, the author examines the present day relevance of the Soviet rail system to the logistic support of a major military operation, particularly a NATO-Warsaw Pact conflict. The great bulk of the material is extracted from Soviet sources. This was done in an attempt to obtain a Soviet perception of the problem. However, since the problem is not specifically addressed in the open Soviet press, a significant amount of analysis is required. For example, that which is not printed may be more significant than that which is. Since a certain degree of this sort of analysis is employed in this paper, compendiums of relevant articles from selected Soviet sources are included as annexes.


 The author concludes that rail transport still constitutes a vital portion of the Soviet military logistics system; and that, in spite of a continuing reliance on rail transport, long-standing deficiencies continue to exist which would hamper the use of the rail net in any future conflict.

TABLE OF CONTENTS

Foreword	ii
Summary	iii
Introduction	1
Soviet Perceptions of the Role of Rail Transport in Modern Military Logistics	5
<u>Krasnaia Zvezda</u>	7
<u>Tyl i Snabzhenie</u>	9
<u>Zheleznodorozhnyi Transport</u>	11
Analysis	11
Rail System Deficiencies	15
Characteristics of the Rail Net Itself	16
Characteristics of the Locomotive Park	22
Insufficiencies in Other Areas of Rail Transport	27
Conclusions	27
Annex A	29
Annex B	39
Footnotes	44
Bibliography	47

INTRODUCTION

It has become customary among Western military analysts to assess the Soviet logistic system as suitable only for the short, highly mobile war that the Soviets seem to feel would be most likely in a NATO-Warsaw Pact clash. Graham Turbiville makes this point quite succinctly in introducing an article concerning Soviet logistic support.¹ In the same article he states that such a point of view is dangerous in light of recent Soviet developments in the logistic area. It would seem that consideration of this issue naturally divides into consideration of two subordinate issues. The first of these issues is, of course, whether or not a NATO-Warsaw Pact war would, in fact, be short in duration and also decisive in conclusion. The second would be the issue of the capacity of the Soviet logistic system in a protracted conflict.

If the Soviet conception of a short violent war is accepted, the alleged inability of their logistic system to support a protracted conflict is not of consequence. On the other hand, a conception which envisions a protracted high intensity conflict forces the re-examination of the Soviet logistic posture.

Captain Jesse W. Miller writing in Army postulates a case wherein a NATO-Warsaw Pact conflict would be "a frustrating and bloody war of attrition

more like World War I than World War II."² While the preceding statement may seem a bit extreme, Captain Miller presents a well-reasoned argument that shows the folly of ignoring the possibility of a protracted conflict in Europe. The keystones of his argument are the extreme lethality of modern weaponry coupled with high use of consumable supplies and the urbanized geography of Central Europe. In essence his thesis is that the urban character of the battlefield and paralysis of the road nets with civilian refugee traffic will restrict maneuvers to the extent that firepower will become dominant and that after a short period of time the ability of each side to re-supply and re-arm will become the critical factor.

Captain Miller is not alone in calling for re-examination of the character of a future war in Europe. He apparently has influential counterparts in the Soviet armed forces. Turbiville concludes his article by stating "All available evidence would seem to indicate that this recognition (that inadequate logistic support is a frequent limiting factor in the successful conduct of combat operations) along with Soviet uncertainties as to the nature of a future war in Europe, has resulted in the establishment of a logistic system well suited to a short nuclear war, but possessing the flexibility to supply theater forces

under conventional conditions for prolonged periods."³

Having established that the character of a future war in Europe is uncertain enough to cause Soviet concern certainly would seem to warrant consideration of the issue of the Soviet logistic system's capacity to sustain a prolonged conflict. Historically, the Soviet railway system has constituted a major portion of the logistic capacity of the Red Army.

Historians of World War I and World War II era and military memoir writers are nearly unanimous in attributing critical importance to the continued operation of key segments of the Russian rail network. German ex-generals, in particular, seem to like to base "how it might have been" dissertations on the premise that the seizure of the rail nerve center of Moscow would have paralyzed the Soviet rail system and thereby have so weakened Russian ability to resist that German victory would have been assured.⁴

In spite of this near unanimous appraisal of the criticality of the Soviet rail network in a World War II context, very little seems to have been done with respect to determining if this 30 year old wisdom has any applicability in assessing the strengths and weaknesses of the Soviet Army of today. The tendency seems to be to dismiss rail technology as an anachronism and concentrate instead on analysis of such features of

modern Soviet logistic systems as the "delivery forward" concept and tactical pipelines. In view of the overbearing preponderance of the rail system in civil transport, such a position would seem to be on the same order of short-sightedness as rigid insistence on the rapidly concluded mobile war theory. In 1971, for example, Soviet rail transport accounted for approximately 64.5 per cent of the total ton/kilometers of freight haulage in the Soviet Union. Percentages attributed to other forms of transport were as follows: water (both riverine and coastal) 21.5 per cent, pipelines - 8 per cent, road - 5.8 per cent and air - 2 per cent.⁵ It would seem highly unlikely that these percentages would undergo instant transformation in the event of war to the point that rail transport would play an inconsiderable role.

With this in mind this paper will attempt to ascertain the Soviet perception of the present day role of rail transport in military logistic operations and to identify those problem areas which might develop into liabilities in the event of heavy use of the Soviet rail system for military logistics.

SOVIET PERCEPTIONS OF THE ROLE OF RAIL TRANSPORT
IN MODERN MILITARY LOGISTICS

Consideration of the Soviet perception of the continuing role of rail transport in modern military logistics is immensely complicated by the fact that this topic is simply not discussed in any reasonably direct way in the Soviet press. There are, of course, two obvious possible reasons for this silence. First, the subject may simply not warrant consideration in much the same way as the consideration of the use of the buggy whip in armored warfare is not relevant and germane. The second explanation is that the subject is considered of central importance and its discussion is restricted or prohibited for reasons of military security. An attempt can often be made to determine which of these factors is operating through careful analysis of those articles which deal with the subject matter in question in a peripheral way. For reasons to be enumerated in the concluding remarks of this section of this paper, the author believes that the second factor, that of military security, is the operative factor in this case.

Since many of the conclusions reached in this paper are based on what is not said and even when or where it is not said, a discussion of the research methodology employed would seem to be in order at the

outset.

Three major Soviet periodical publications were selected for their seeming potential applicability to the question under consideration. Periodicals were selected because of their greater timeliness in terms of consideration of the problem in a real time sense and because a review of the available non-periodical literature was nonproductive. For example, Marshal Grechko's book Vooruzhennie Sily Sovetskogo Gosudarstva (Armed Forces of the Soviet Union) Moscow, 1975, which according to the author, seeks to afford the Soviet people with a greater understanding of the nature of their armed forces, does not even mention the existence of railway troops. The periodicals selected were Krasnaia Zvezda (Red Star), the daily newspaper published by the Ministry of Defense; Tyl i Snabzhenie (The Rear and Supply), a monthly journal also published by the Ministry of Defense and dealing with administrative and logistic aspects of military operations, and Zheleznodorozhnyi Transport (Railway Transport), a monthly journal published by the Ministry of Routes of Communication. The first two publications were examined for articles that dealt in any way with rail transport. Zheleznodorozhnyi Transport was examined for references to military use of railway transport. All issues of each of the three journals published in 1975 were read

and pertinent articles extracted.

KRASNAIA ZVEZDA

During 1975, 32 articles pertaining in total or major portion to railway operation appeared in Krasnaia Zvezda. These articles are listed along with a short summary of content in Annex A for the convenience of the reader.

Of the 32 articles, 21 pertain to construction of the Baikal-Amurskaia Magistral (BAM). Most of these articles are in the nature of reporting on the heroic achievements of socialist labor and are more in the nature of propaganda than serious discussions of railway operations. One fact of military significance does emerge from the propaganda fog, however. This is that large numbers of railway troops still exist in the Red Army and that their role in the construction of the BAM is considerable. References to bridge building battalions are frequent.

Of the remaining 11 articles, eight deal with narrowly proscribed rail subjects such as construction of a new passenger car maintenance depot at Kharkhov. One of these articles has some military interest in that it is an "advertisement" encouraging applications to a military academy specializing in training officers for service with the railway troops (reference number 8, Annex A).

This leaves only three articles published during 1975 in Krasnaia Zvezda which deal with rail transport in any generalized way. One of these (reference number 30, Annex A) is an enumeration of the planned goals of the 10th Five Year Plan (1976-1980) and is somewhat useful in analyzing shortcomings of the railway system, but contains no mention of the military.

The second article is a short but interesting article concerning the role and mission of railway troops (reference number 3, Annex A). The most interesting statement made in this article is that "railway troops, like any other soldier, must be constantly ready for war." This phrase constitutes the only reference in an entire year's publication of Krasnaia Zvezda that railway troops, presumably working on railroads, are required for the conduct of modern military operations. By deduction, one can reason that some role is then visualized for the railways in future military operations in wartime.

The third article (reference number 17, Annex A) is most interesting for what it does not say considering its date of publication. The third of August 1975 was All Union Railroad Workers' Day. According to Kalendar Voina 1975 (The Soldier's Calendar - 1975)⁶ it was also the day honoring the "Soldiers of the Steel Highways" or railway troops. The calendar, which is

actually a thick little volume of information useful to the soldier related to specific dates, contains a full page of information detailing the exploits of the railway troops from 1917 through World War II. The Krasnaia Zvezda article, rather surprisingly, does not even mention the existence of railway troops, but rather contents itself with a rather mundane recounting of the accomplishments of the railroads during the first four years of the ninth Five Year Plan. The length and positioning of the article are strikingly similar to the 28 May article honoring the "Pogranichniki" or border troops. The border troops are mentioned by name, however. There seemingly is no obvious reason for not touting the railway troops on their "day", since their existence and even heroic efforts are widely reported in other issues.

TYL i SNABZHENIE

There were 11 articles concerning railroad troops published in Tyl i Snabzhenie during 1975. These articles are listed along with a summarization of content in Annex B for the convenience of the reader. Six of the 11 articles concern themselves with the construction of the BAM, two with the exploits of railway troops during World War II and the remainder with more general railway subject matter.

Of interest are the articles by Colonel-General Kruikov, Chief of Railway Troops, (reference number 3, Annex B) and Lieutenant-General Iu. Maiorov, Chief of the Political Directorate of Railway Troops (reference number 6, Annex B). Both of these articles mention the missions of railway troops and emphasize the necessity of the railway troops to be ready to keep the railways functioning under wartime conditions. Lieutenant-General Maiorov's article is all the more interesting in his postulating that the rationale for railway troops working on the BAM is to approximate combat conditions in training.

However, the most interesting article to appear during the year 1975 in Tyl i Snabzhenie was the article written by a trio of officers headed by Colonel S. Fedorov (reference number 9, Annex B). This article describes, with a bare minimum of reading between the lines required, a widespread system of railway freight shipping controlled by the military. The system apparently works in such a way that military officers, rather than civilian railway employees, handle the required documentation and oversee loading and unloading by military troops. Military guards are provided in those "many instances" that the character of the shipment requires it. The existence of such an elaborate system wherein the civil railroaders, themselves a

paramilitary organization, are excluded from all but the actual hauling of military shipments from one point of military control to another, testifies to the degree of reliance of the Soviet Army on rail transport. The existence of such a system in peacetime would seem to facilitate full military utilization of the rail net in the event of war. Major-General Chichikin's article (reference number 4, Annex B) does not mention the system described above, but his comments make much more sense if they are viewed in the light of the existence of such a system.

ZHELEZNODOROZHNYI TRANSPORT

There were no articles in Zheleznodorozhnyi Transport during 1975 which mentioned military use of the railway net in anything other than a straightforward historical context connected with the 30 Year Jubilee celebrating the end of World War II.

ANALYSIS

The material found in the three selected periodicals supports the following conclusions: (1) Railway troops are still a component part of the Soviet Army, apparently in significant numbers; (2) A wartime mission involving railroads is envisioned for these troops; and (3) The Soviet Army makes wide use of rail transport in peacetime and apparently has its own

organizations for controlling rail shipments.

Nothing relating to the scope or manner of rail logistic support of a NATO-Warsaw Pact conflict was printed. Nevertheless, given the fact that the Soviets continue to emphasize preparedness to operate railroads under wartime conditions, certain deductions can be made.

The last time that the Soviet Army was forced to conduct logistic operations under anything approaching the stress of wartime was the 1968 invasion of Czechoslovakia. Although this operation took place nearly 10 years ago, it remains one of the best bases for examining likely courses of action in the future. Writing about the invasion of Czechoslovakia, Leo Heiman has this to say about Soviet logistic services:

In considering the deficiencies and shortcomings of Soviet logistic services in Czechoslovakia, it should be recognized that railways are much more efficient than highways and motor transport in the USSR. West of the USSR borders, however, railways have a narrower gauge and a much lower carrying and handling capacity than Soviet railroads. In most Eastern European countries outside the Soviet Union, many strategic locations cannot be reached by train, nor is the highway system well developed. Logistic planners of invading armies must, therefore, map out alternative delivery routes, utilizing the organic transport of operational forces, as well as the existing transportation services.

This had not been done in Czechoslovakia, possibly because the Soviet formations lacked sufficient organic transport for their own immediate needs, Soviet armored and mechanized divisions came with numerous tanks and armored personnel carriers, but had fewer trucks than comparable Western formations and few specialized vehicles for logistic support.

Normally, every Soviet Army has its own railhead which handles all supply trains within a radius of 60 to 95 miles of the operational sector. The railhead serves three to four central depots located about 15 to 20 miles behind the battlefront. Each depot serves two to three divisions through a road network. Therefore, trucks are used only for the final 15 to 20 miles separating the central depots from the frontline units. But the rapid advance of Soviet mechanized forces in Czechoslovakia showed this entire concept to be hopelessly outdated.⁷

It seems highly likely that the Soviets have arrived at much the same conclusions and have taken steps to correct the perceived deficiencies in the intervening eight years. The form of this change is described by Turbiville in this way: "While Soviet divisions have a mobile, streamlined logistics tail (a concept developed in World War II) the 'delivery forward' concept dictates that the bulk of logistic resources be found at army and front level."⁸

During the invasion of Czechoslovakia and even in subsequent large scale maneuvers, the Soviets have

mobilized reserve motor transport units utilizing large numbers of trucks from the national economy. These units are, of course, used as part of the logistic concentration at front levels and below. The net effect of this action is to make internal transport in the USSR even more rail dependent than its normal 65 per cent.

It then seems obvious that when all factors are considered that the railways will be the principal logistic delivery means down to at least front level and probably down to army level whenever possible. This rail link would become especially critical in a protracted conflict which would consume war reserves and necessitate delivery to the fighting fronts of munitions produced in a mobilized Soviet war industry.

The key to how such a system might operate may very well be provided by present day Soviet troop deployment. It is unquestionably a facet of Soviet post World War II strategy that any future land war in Europe not be fought on the territory of the Soviet Union. To this end troop concentrations, which would in wartime become fronts, have been established in East Europe. If the rear boundary of the front for logistics purposes were established as the Soviet-bloc country border, one of the major problems concerned with rail support of Soviet military operations

could be mitigated.

The problem referred to here is the obvious one of gauge difference between the railways of the USSR and those of all other European countries; the former being 5'0" and the latter being 4'8 1/2". This fact makes the Soviet border a required transshipment point even for "through" rail shipments. Thus, it would seem logical to utilize this required transshipment point for the added function of transfer to the logistic assets of the fronts. The distance from railhead to division that Soviet motor transport is capable of supporting is an open question. It is almost certainly much greater today than the "15 to 20" miles cited prior in the quotation by Mr. Heiman. On the other hand, the 750 odd kilometers which separate the borders of West Germany and the USSR represent a quite significant motor transport haul. Of course, nothing along the lines of the preceding discussion is to be found in the Soviet press. In point of fact, the gauge difference of the Soviet railways was not in itself mentioned.

RAIL SYSTEM DEFICIENCIES

Even though gauge difference is not mentioned in the Soviet press, non-periodical literature and the journal Zheleznodorozhnyi Transport contain many

references to characteristics of the Soviet rail system which could become critical liabilities under conditions of heavy wartime rail usage. Some of these characteristics are perceived as insufficiencies even in the peacetime rail system, while others would only become apparent under the changed traffic flows required for the support of a war in Europe.

CHARACTERISTICS OF THE RAIL NET ITSELF

In the introduction of this paper reference was made to the 30 year old wisdom which held that seizure of the critical rail junction of Moscow would paralyze the Soviet logistic effort. For this wisdom to have any present day validity, two factors must have remained in effect. The first of these, of course, is that rail transport must have remained a critical part of Soviet wartime logistic transport. The facts presented up to this point of the paper tend to support the conclusion that this factor remains operative. The second limiting factor is, of course, that the rail net must still exist today in essentially the same form that it did in 1941.

The map on the following page taken from a Soviet source printed in 1967 clearly shows that the 1966 rail system in the European part of the USSR differs only in detail from the rail net existing in 1917!⁹

Conversations with Mr. Constantin A. Krylov, Professor of Economics at the U.S. Army Institute for Advanced Russian and East European Studies, indicate that a significant percentage of the rail lines depicted on the map as having been built between 1917 and 1966 were, in fact, existing lines in 1917 which have been double tracked in the Soviet period. A Soviet rail atlas published in 1974 indicates that the 1966 net shown in the map accurately portrays the Soviet European rail net as of 1973.¹⁰ Various articles appearing in the current press support the thesis that the great bulk of the 2,000 odd kilometers of new rail construction claimed for each year of the ninth Five Year Plan (through 1975) is taking place in the Asiatic USSR.¹¹ The inescapable conclusion is that the twin factors which led analysts of World War II to conclude that Moscow constitutes a critical target in terms of its importance as a rail center remain today.

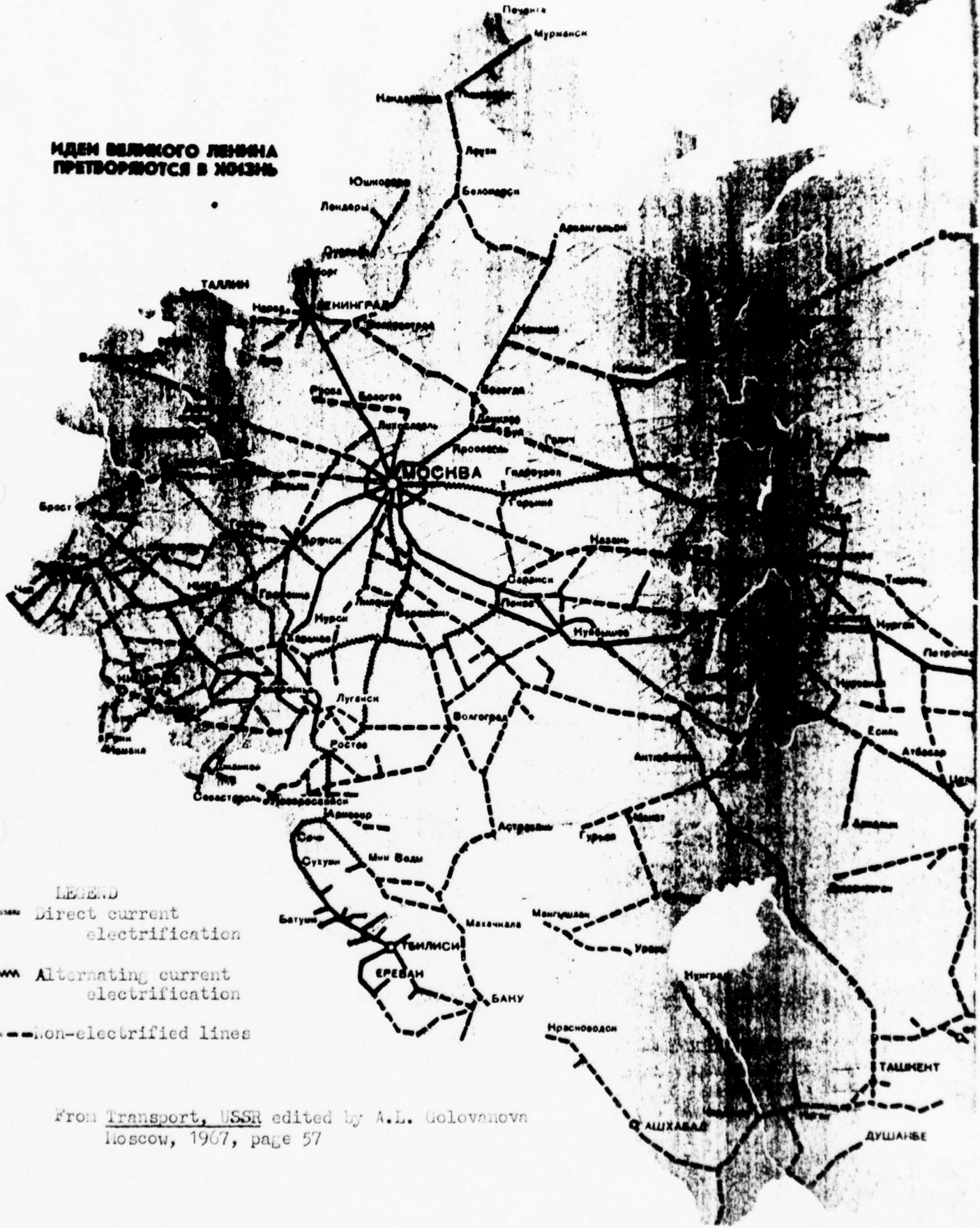
Holland Hunter theorizes that there are sound economic reasons for the lack of development of the Soviet European rail net. He states: "The decision to give secondary priority to agriculture had important implications for the growth of Soviet railroads. The inherited rail network already reached existing producing centers and required relatively modest expansion to meet the needs of a heavy industrial development program."¹²

Current rail construction, with the possible notable exception of BAM, fits this conception in that most new lines appear to have as their principal purpose the opening up of new deposits of raw materials. Nevertheless, it is difficult to believe that a strategic military weakness is allowed to persist in the Soviet Union for purely economic reasons.

A second characteristic of the rail net as a whole that has acted to intensify the reliance on Moscow as the rail hub of the country since World War II is the pattern of electrification. The map on the following page taken from the same Soviet source as the first map clearly illustrates this phenomenon. It is of course obvious to even the most uninformed that the approximately 3,000 electric locomotives in service in the Soviet Union are restricted to electrified lines, but it is less obvious that the locomotives designed for use on the line electrified with direct current are not suitable for use on lines electrified with alternating current and vice versa. When this fact is taken into account the picture very clearly emerges of lines radiating from Moscow, and the inability of the electric locomotive fleet to make any significant contribution west of Moscow is apparent.

Once again the reason for the pattern of electrification would seem to be economic in nature. The

**ИДЕИ ВЕЛИКОГО ЛЕНИНА
ПРЕТВОРЯЮТСЯ В ЖИЗНЬ**



LEGEND

— Direct current
electrification

~~~~~ Alternating current  
electrification

--- Non-electrified lines

From Transport, USSR edited by A.L. Golovanova  
Moscow, 1967, page 57

electrified lines are the most heavily traveled lines. As of 1970 the electrified lines accounted for about 25 per cent of the route kilometers (33,900 out of 135,200) but 48.2 per cent of the freight tonnage.<sup>13</sup>

The reason for the varying forms of electrification are considerably less clear. The 3,000 volt direct current net (see map) represents obstinate clinging to outmoded technology. Not only is the operation of such a system uneconomic compared with a high voltage alternating current system, but the characteristics of the distribution system make the direct current system more vulnerable to attack and sabotage.<sup>14</sup> The subtleties of these arguments are not lost on Soviet engineers. A concise reasonably complete setting forth of essentially the same points enumerated above can be found in the introduction to the third edition of Kak Ustroen i Rabotaet Elektrovoz (How the Electric Locomotive is Built and Works).<sup>15</sup> The same source suggests that modern technological breakthroughs, particularly series production of thyristors, will enable construction of a locomotive capable of running on both systems. This may very well be the case, after all the French have been building locomotives capable of both AC and DC operation for years, but it still does not satisfactorily explain the widespread introduction of World War I era technology after World War II.

In short, the railway electrification of which the Soviets are so proud, might prove to be a liability in wartime because its form and incompatible segments will force even more traffic to be routed through Moscow than might otherwise be the case. Of course, electrified railways are inherently more vulnerable in wartime than non electrified lines because of the necessity to repair catenary structure as well as the track itself after bomb damage. The necessarily rather precise relationship between the overhead contact wire and the track below enormously complicates such standard wartime railroad practices as building bypasses around damaged bridges or choke points. Perhaps these factors have operated to limit electrification of the rail lines West of Moscow (see map, page 20). As of 1970 only 407 track/kilometers of electrification had been installed in the Belorussian SSR and the three Baltic Republics.<sup>16</sup>

#### CHARACTERISTICS OF THE LOCOMOTIVE PARK

The preceding discussion makes it clear that the rail net of greatest concern to NATO is served by other than electric locomotives. Since the Soviet Union retired their last steam locomotives in 1974, this means that the locomotive type of greatest concern is the diesel. Consequently the following comments are

addressed to insufficiencies in the Soviet diesel fleet. The comments are, by and large, applicable also to electric motive power, but the specific facts and figures cited refer to diesel locomotives.

Soviet diesel locomotives appear to have deficiencies in three major areas: reliability, flexibility and durability. Once again, direct statements of specific deficiencies are rare, even in the trade press, making manipulation of figures from various sources mandatory in most cases in order to obtain a clear picture. Dr. Hunter, noted scholar of transport economics, aptly describes the frustrations of this kind of research by stating: "Serious students of the Soviet economy have found Soviet data usable, though often incomplete, ambiguous and misleading."<sup>17</sup>

The preceding statement certainly applies to any concrete calculation of present day Soviet diesel locomotive reliability. Figures are available from a number of sources (although most are based on Transport i Sviaz - 1967),<sup>18</sup> which permit a reasonably close calculation of diesel locomotive reliability as of 1965. This figure turns out to be in the neighborhood of 35 per cent down time, presumably for maintenance. Unfortunately, the relevance of this figure to the present day situation is hard to determine, since some of the parameters necessary for the calculations, notably the

number of locomotives on the roster, were omitted from the 1972 issue of Transport i Sviaz.

However, the 1972 edition does contain figures referring to the average daily distance traveled by diesel locomotives. The 1970 figure is 475 kilometers.<sup>19</sup> A figure for the number of man/hours of maintenance required per 1000 locomotive kilometers was printed in Zheleznodorozhnyi Transport. This figure expressed as an all union average is 51.2.<sup>20</sup> If the assumption is made that the average daily distance traveled has not significantly decreased since 1970 (the figure had remained constant for the period 1960-1970 with respect to the sensitivity of these calculations), it becomes obvious that a diesel locomotive requires about 25 man/hours of maintenance per day. It is difficult to see how this could be accomplished while significantly reducing the 1965 down time percentage of about 35 per cent.

Deficiencies in the area of flexibility are much more subjective in nature than the calculations of reliability. The principal deficiency in this area is that Soviet diesels do not appear to be equipped for multiple unit operation. This conclusion is based on personal observations by the author in the Soviet Union and examination of numerous photographs in the trade press.

It is common US railroad practice to hook together whatever combination of diesel units is available and required by the weight of the train involved. The required connectors and control gear have been standardized and it is not at all unusual in the United States to see a train being pulled by diesel units belonging to several different railroads all under the control of one engineer.

Soviet practice, on the other hand, appears to be to design a standard locomotive and fit the weight of the train to the locomotive's hauling capacity over a given stretch of track. This practice might be acceptable under Soviet peacetime conditions where the customer has little to say about delivery date of his shipment, but it would seem to be a handicap under wartime conditions.

Since the Soviets have been unable until very recent times to build a single unit locomotive with the horsepower that they desire in their "standard" locomotive,<sup>21</sup> the common practice has been to permanently couple two identical units back to back and call the result a "two section locomotive". This practice causes a penalty to be paid in flexibility (and in reliability, for that matter) since, if either locomotive requires maintenance, the second unit must stand idle while maintenance is being performed on the first.

V. N. Tveritin points out that a deficiency with respect to reliability is that "two section locomotives" do not, in practice, run at the same speed causing excessive wear on the slower unit."<sup>22</sup> The inability to achieve harmonious running of permanently coupled identical units points out the magnitude of the Soviet lag in this area.

The durability of the Soviet diesel locomotive fleet is not openly discussed. On the other hand the planned construction goal for the 10th Five Year Plan would suffice to nearly replace the present fleet.<sup>23</sup>

This construction goal does not include Czechoslovakian production. That Czech built locomotives make up a significant portion of the Soviet diesel fleet is demonstrated by an article in Teknika Molodezhi about the 2,000th Czech built diesel of a single type (ChME - 3) to go into service in the USSR.<sup>24</sup> When Czech production for the Soviet railway system is taken into account, the total figure is certainly large enough to replace the existing fleet, even allowing for 10 per cent or so increase in roster size. It is hard to visualize how much more than such a 10 per cent increase in quantity of locomotives could be used on the existing or projected rail net.

This does not in and of itself mean that the useful lifetime of a Soviet diesel locomotive is five years

(almost two of which are spent sitting still), but it almost certainly means that, for one reason or another, the existing Soviet diesel locomotive fleet will not achieve the US average age before retirement of 15 years for a main line unit and 25 years for a switcher.<sup>25</sup>

#### INSUFFICIENCIES IN OTHER AREAS OF RAIL TRANSPORT

Insufficiencies exist with respect to other aspects of Soviet railway transport and can be documented using much the same type of source material that was used above. Suffice it to say for the purposes of this paper that such deficiencies exist and can be documented.<sup>26</sup> Whole books could be written on deficiencies in individual areas of railway operations. Such books are, in fact, quite common in the Soviet press. The need for brevity, of course, prevents such treatment here.

#### CONCLUSIONS

The most obvious conclusions gained from the foregoing would seem to be that the Soviet rail network remains a vital cog in the military logistics system, and that institutionalized deficiencies which lessen the effectiveness and increase the vulnerability of the railway system in its wartime transport role are permitted to continue to exist. This is most true when seen in the context of a potential NATO-Warsaw Pact

conflict.

The reasons behind the continued existence of a well documented strategic weakness are somewhat unclear. Perhaps the entrenched bureaucracy of the railway system coupled with the necessity to cross ministerial lines makes it impossible for military planners to correct deficiencies in the rail system.

Nevertheless, for whatever reason, the almost paradoxical situation does exist. Soviet logistic transport down to at least front level remains on the rails and is vulnerable for the reasons elucidated above.

Target planners of potential adversary states to the Soviet Union would do well to consider the Soviet rail network in any planning being done for a protracted conflict. The most lucrative target areas would seem to be the network of rail lines in the immediate vicinity of Moscow and the gauge change points at the western border of the Soviet Union.

Locomotive maintenance centers should also prove lucrative targets since at any given time, one third of the locomotive fleet can be expected to be found there. Destruction of the physical and personnel assets of these maintenance points should severely complicate operating problems for the remainder of the maintenance prone diesel fleet.

## ANNEX A

COMPILATION OF ARTICLES APPEARING IN KRASNAIA ZVEZDA

(RED STAR) DURING CALENDAR YEAR 1975

WHICH DEAL WITH RAILWAY TRANSPORT

| Reference Number | Date       | Page | Title                                                                                                                                                                                                                                                                                                                             | (Translated Title)                                 |
|------------------|------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 1                | 6 January  | 4    | BAM - 3,200 Mostov                                                                                                                                                                                                                                                                                                                | (BAM - 3,200 Bridges)                              |
|                  |            |      | Full column article describing multitudinous problems of bridge construction on the BAM (Baikal - Amurskaia Magistral). Specifically enumerated as examples of the severe conditions encountered are the occurrence of ice up to three meters thick and the necessity to place bridge footings in permafrost.                     |                                                    |
| 2                | 10 January | 2    | Sorevnuitsia Stroiteli BAMA                                                                                                                                                                                                                                                                                                       | (The Builders of the BAM Compete Among Themselves) |
|                  |            |      | The article describes how railroad troops, particularly bridge building units, are overfulfilling their plans with respect to construction of the BAM in spite of the severe weather conditions encountered. This success is attributed to "socialist competition" which is defined as production in excess of established norms. |                                                    |
| 3                | 10 January | 1    | Soldati Stal'-nykh Magistralei                                                                                                                                                                                                                                                                                                    | (Soldiers of the Steel Highways)                   |

| Reference Number | Date        | Page | Title                                                                                                                                                                                                                                                            | (Translated Title)                        |
|------------------|-------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
|                  |             |      | A photo article which describes in general terms the role and missions of railroad troops. It focuses on their railway construction mission and emphasizes that railway troops, like all soldiers, must maintain constant readiness for war.                     |                                           |
| 4                | 26 January  | 1    | Rastet Most Nad Ob'iu                                                                                                                                                                                                                                            | (The Bridge Over the Ob River is Growing) |
|                  |             |      | Spot article about rail bridge construction over the Ob River on the Tumen-Surgut Line. Describes newly constructed line as 700 km. in length and gives as purpose for construction the exploitation of a new oil field.                                         |                                           |
| 5                | 5 February  | 4    | Pervoprckhodtsy                                                                                                                                                                                                                                                  | (Those Who Pass Through First)            |
|                  |             |      | Major article describing heroic efforts of railway troops engaged in the first phase of construction of the BAM. For the most part the work described is related to the construction of camps to be used by later arrivals who will actually build the railroad. |                                           |
| 6                | 15 February | 4    | BAM - Na Sluzhbu Rodine                                                                                                                                                                                                                                          | (BAM - In Service of the Motherland)      |
|                  |             |      | Article describing excellent work done by bridge building units through application of "socialist competition". The                                                                                                                                              |                                           |

| Reference Number | Date | Page | Title | (Translated Title) |
|------------------|------|------|-------|--------------------|
|------------------|------|------|-------|--------------------|

article also describes a meeting of a number of high level officials to discuss means of heightening this competition. The scope of the article is considerably more proscribed than the title would indicate.

|   |         |   |                       |                                           |
|---|---------|---|-----------------------|-------------------------------------------|
| 7 | 5 March | 1 | Agitpoezd Idet Na BAM | (An Agitation Train is Traveling the BAM) |
|---|---------|---|-----------------------|-------------------------------------------|

A small article describing a rail mounted propaganda/cultural road show targeted on the constructors of the BAM. The article states that the lectures included descriptions of the great feats performed by the "Far Eastern Railroads" during the latter phases of World War II. No mention is made, however, of any present day military importance of either the "Far Eastern Railroads" or the BAM itself.

|   |         |   |                                                             |                                                                                                  |
|---|---------|---|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 8 | 8 March | 4 | Ob'iavliaiut Priem Na Pervyi Kurs: Voennye Uchilishcha Tyla | (Announcement Is Made of Vacancies in the First Course: Military Academies of the Rear Services) |
|---|---------|---|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------|

This article is an "advertisement" encouraging application for acceptance at four different military academies of the rear services. One of the four academies, the Leningrad Military Academy of the Rear Services, is described as specializing in training

| Reference Number | Date     | Page | Title                                                                                                                                                                                                | (Translated Title)                |
|------------------|----------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|                  |          |      | officers for service in the Railroad Troops. The training is described as including both construction and operation instruction related to railroads.                                                |                                   |
| 9                | 17 March | 4    | S Chevo Nachinaetsia Doroga                                                                                                                                                                          | (From Whence Does the Road Begin) |
|                  |          |      | This somewhat fancifully titled article describes the scope of the work on the BAM with emphasis on overfulfillment of work norms by Railway Troops.                                                 |                                   |
| 10               | 20 March | 2    | Stroiteli BAMA                                                                                                                                                                                       | (Builders of the BAM)             |
|                  |          |      | Full column article stressing the need for close party supervision to insure optimal work efficiency under the severe and adverse conditions of the area through which the BAM is being constructed. |                                   |
| 11               | 22 March | 4    | Voennye Dorogi Ladogi                                                                                                                                                                                | (Military Routes of Lake Ladoga)  |
|                  |          |      | Major article describing "superhuman" efforts of railroaders to keep Leningrad supplied during German siege of World War II. No mention made of present day significance of railroads.               |                                   |
| 12               | 24 March | 4    | Metall Dlia BAMA                                                                                                                                                                                     | (Metal for the BAM)               |
|                  |          |      | Short article describing how "Komsomolniki" in Leningrad decided to send all of their metal produced in excess of the plan to support work on the BAM.                                               |                                   |

| Reference Number | Date     | Page | Title                                                                                                                                                                                                                                                           | (Translated Title)                                                        |
|------------------|----------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 13               | 1 April  | 4    | Marshruti Naznacheniia Dal'nii-Vostok                                                                                                                                                                                                                           | (Designated Routes - The Far East)                                        |
|                  |          |      | Historical article praising efforts of railroaders in moving great numbers of troops from Europe to Asia for operations against the Japanese in 1945. No comment on present day operations or significance of railroads.                                        |                                                                           |
| 14               | 9 April  | 3    | Bitva Na Rel'sakh                                                                                                                                                                                                                                               | (Major Battle on the Rails)                                               |
|                  |          |      | Short article describing heroic acts of partisans during World War II directed against rail communications in the German rear. Great significance is attributed to this activity. No mention of present day importance or stopping or hindering rail transport. |                                                                           |
| 15               | 29 July  | 2    | Stroitel'iam BAMA Nagrady Tsk VLKSM                                                                                                                                                                                                                             | (The Central Committee of the Komsomol Decorates the Builders of the BAM) |
|                  |          |      | Small article dealing with designation of best Komsomol organization on the BAM.                                                                                                                                                                                |                                                                           |
| 16               | 2 August | 3    | Prazdnik Zhelezno-dorozhnikov                                                                                                                                                                                                                                   | (Holiday for Railroaders)                                                 |
|                  |          |      | Small article referring to meeting in Moscow to celebrate All Union Railroader's Day.                                                                                                                                                                           |                                                                           |
| 17               | 3 August | 4    | Segodnia - Vsesoiuznyi Den' Zhelezno-dorozhnikov - Na                                                                                                                                                                                                           |                                                                           |

| Reference Number | Date | Page | Title                               | (Translated Title)                                                                             |
|------------------|------|------|-------------------------------------|------------------------------------------------------------------------------------------------|
|                  |      |      | Stal'nykh Magistral-<br>iakh Strany | (Today is All-<br>Union Rail-<br>roaders' Day -<br>On the Steel<br>Highways of<br>the Country) |

Major article honoring accomplishments of railroaders on their national day. Emphasis is on successful completion of 9th Five Year Plan goals. Some figures of note are as follows: Productivity in 1974 was 3,223,000,000,000 ton/kilometers. Productivity up 19.6 per cent over 1970 figure. Steam locomotives handle only .6 per cent of mainline work and about 15 per cent of switching as of 3 August 1975. Number of kilometers of electrified line as of end of 1974 - 38,000. Number of kilometers of line equipped with automatic signaling during the first four years of the Five Year Plan (1970-1974) 11,000.

NOTE: The treatment given to the railroaders was about equal in size and positioning of the article to the treatment given the Border Troops (Pogranichnykh Voisk) in the 28 May issue. Other categories of troop units such as Military Construction Troops and, of course, the combat arms received much more space and, as a rule, front page treatment.

|    |           |   |                                               |                                                                        |
|----|-----------|---|-----------------------------------------------|------------------------------------------------------------------------|
| 18 | 18 August | 4 | Voiny Na Stroitel'-<br>stve BAMA -<br>Polotno | (Military Men<br>in the Con-<br>struction of<br>the BAM -<br>Road Bed) |
|----|-----------|---|-----------------------------------------------|------------------------------------------------------------------------|

| Reference Number | Date         | Page | Title                                                                                                                                                                                                                                                                         | (Translated Title)                                              |
|------------------|--------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
|                  |              |      | Short article with pictures describing work of a military excavating unit involved in grading work for the BAM.                                                                                                                                                               |                                                                 |
| 19               | 21 August    | 4    | Voiny Na Stroitel'stve BAMA-Mosty                                                                                                                                                                                                                                             | (Military Men in the Construction of the BAM-Bridges)           |
|                  |              |      | Short article with a picture describing construction of a temporary bridge over the Bureia River.                                                                                                                                                                             |                                                                 |
| 20               | 23 August    | 4    | Voiny Na Stroitel'stve BAMA - Gruzy                                                                                                                                                                                                                                           | (Military Men in the Construction of the BAM-Goods or Supplies) |
|                  |              |      | Short article with photos lauding the job done by the Army in providing supplies for the builders of the BAM.                                                                                                                                                                 |                                                                 |
| 21               | 24 September | 1    | Most Cherez Lenu Deistvuet                                                                                                                                                                                                                                                    | (The Bridge Over the Lena River is in Operation)                |
|                  |              |      | Small article noting completion ahead of schedule of a bridge over the Lena River on the BAM.                                                                                                                                                                                 |                                                                 |
| 22               | 27 September | 1    | Most Cherez Amur Vstupil V Stroi                                                                                                                                                                                                                                              | (The Bridge Over the Amur River Has Been Put into Service)      |
|                  |              |      | An article, a letter written by L. I. Brezhnev and a photograph, all concerning the opening of the bridge over the Amur River. Brezhnev's letter refers to the great significance of the bridge to the national economy, but no mention is made of military or defense value. |                                                                 |

| Reference Number | Date         | Page | Title                                                                                                                                                                                                                                                                                                                     | (Translated Title)                                                |
|------------------|--------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 23               | 30 September | 4    | Na Trasse Veka                                                                                                                                                                                                                                                                                                            | (On the Route of the Century)                                     |
|                  |              |      | Short article about Railway Troops working on the BAM.                                                                                                                                                                                                                                                                    |                                                                   |
| 24               | 8 October    | 4    | Novoe Depo Khar'kova                                                                                                                                                                                                                                                                                                      | (A New Depot for Karkov)                                          |
|                  |              |      | A short article describing completion of a new repair shop in Karkov for rail passenger cars.                                                                                                                                                                                                                             |                                                                   |
| 25               | 8 October    | 4    | Most Cherez Kirengu                                                                                                                                                                                                                                                                                                       | (The Bridge Over the Kirenga River)                               |
|                  |              |      | Short article concerning the construction of a bridge over the Kirenga River on the BAM.                                                                                                                                                                                                                                  |                                                                   |
| 26               | 18 October   | 2    | Vklad Voinov V Stroitel'stve BAMA                                                                                                                                                                                                                                                                                         | (The Contribution of Military Men in the Construction of the BAM) |
|                  |              |      | A lengthy article on political work stressing how the party is ensuring highest work productivity among military units working on the BAM. The article states that it is "well known that many Railway Troops are working on the BAM" but does not mention any real or potential military significance of the BAM itself. |                                                                   |
| 27               | 22 October   | 4    | Tol'ko Odin Episod - Ispytanie                                                                                                                                                                                                                                                                                            | (Just One Episode - An Ordeal or Trial)                           |

| Reference Number | Date        | Page | Title                                                                                                                                                                                 | (Translated Title)                                                                                 |
|------------------|-------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|                  |             |      | Lengthy article describing actions taken by Railway Troops building a bridge over the Bureia River on the BAM, when their work is threatened by high water.                           |                                                                                                    |
| 28               | 2 November  | 4    | Pesnia o BAME                                                                                                                                                                         | (A Song of the BAM)                                                                                |
|                  |             |      | A note about a song written by a captain; the song is about BAM.                                                                                                                      |                                                                                                    |
| 29               | 16 November | 4    | Posle Sluzhby Na BAM                                                                                                                                                                  | (After Service on the BAM)                                                                         |
|                  |             |      | An interview with a Lieutenant-Colonel who has returned to Leningrad after serving with BAM construction troops. He makes the statement that "many military men work on the project". |                                                                                                    |
| 30               | 14 December | 1-6  | Osnovnye Napravleniia Razvitiia Narodnogo Khoziaistva SSSR Na 1976-1980 Godi                                                                                                          | (Fundamental Directions of Development of the National Economy of the USSR in the Years 1976-1980) |

This article occupies 6 pages of a special double issue (8 pages). The article concerns itself with the goals established for the tenth Five Year Plan (1976-1980). That part of the article which is subtitled Razvitie Transporta i Sviazi (Development of Transport and Communications) contains specific goals for the railroads during the designated period.

| Reference Number | Date        | Page | Title                                                                                                                                            | (Translated Title)               |
|------------------|-------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
|                  |             |      | Besides such general statements on increase in speed, reduction in turnaround and switching time, the following more concrete figures are given: |                                  |
|                  |             |      | Kilometers to be double tracked                                                                                                                  | 2,800                            |
|                  |             |      | Kilometers of automatic signaling to be installed                                                                                                | 2,500                            |
|                  |             |      | Kilometers to be placed under "centralized dispatching"                                                                                          | 16- 17,000                       |
|                  |             |      | Kilometers of new rail lines to be built                                                                                                         | 3,000                            |
|                  |             |      | Production of:                                                                                                                                   |                                  |
|                  |             |      | Electric locomotives                                                                                                                             | 2,200                            |
|                  |             |      | Diesel main line locomotive units (sektsii)                                                                                                      | 6,400                            |
|                  |             |      | Diesel switchers                                                                                                                                 | 2,500                            |
|                  |             |      | Freight cars                                                                                                                                     | 386,000                          |
|                  |             |      | Passenger cars                                                                                                                                   | 16,600                           |
| 31               | 17 December | 4    | I Poidut Poezda                                                                                                                                  | (More Trains Will Run)           |
|                  |             |      | Short article describing opening of a new section of the Moscow Metro.                                                                           |                                  |
| 32               | 18 December | 4    | Blagodariat Stroitieliam BAMA                                                                                                                    | (They Thank the Builders of BAM) |
|                  |             |      | Short article concerning establishment of a library for construction workers on the BAM.                                                         |                                  |

## ANNEX B

| Reference Number | Issue Number | Pages | Title                                          | (Translated Title)                        | Authors                                       |
|------------------|--------------|-------|------------------------------------------------|-------------------------------------------|-----------------------------------------------|
| 1                | 1            | 43-46 | Geroicheskie Dela Voennykh Zheleznodorozhnikov | (The Heroism of the Military Railroaders) | Lt. Col. (Ret)<br>I. Korshukov                |
| 2                | 4            | 34-37 | Na BAME, U Pervorokhodtsev                     | (On the BAM, about Those Who Pass First)  | Major G. Berik                                |
| 3                | 4            | 50-54 | Na Stal'nykh Magistraliakh                     | (On the Steel Highways)                   | Col.-Gen. A. Kruikov, Chief of Railway Troops |

A somewhat rambling article beginning by describing in some detail the terrain and climate of the area through which the BAM will pass and concluding by praising the efforts of railway troops and "komsomolniki" (apparently one and the same group of people) in establishing camps for future workers. Gives the length of the BAM as 3,150 kilometers.

The great bulk of this article concerns efforts of railway troops during World War II. The general concludes by stating that the basic nature of the railway troops has changed in the 30 years since the end of the war. The troops are now capable of employing modern technology to quickly establish rail links anytime, anywhere. The author implies that the principal reason for the construction of the BAM is to tap the vast resources of the area.

| Reference Number | Issue Number | Pages | Title                                                                                                                                                                                                                                                                                                                                                                               | (Translated Title)                                             | Authors                                                               |
|------------------|--------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------------------------|
| 4                | 4            | 71-77 | Razvivat' Materialno-tekhnicheskuyu Bazu Voinskikh Perevozok                                                                                                                                                                                                                                                                                                                        | (To Develop the Material Technical Base of Military Transport) | Maj.-Gen. Chichikin                                                   |
|                  |              |       | <p>The article deals with shortcomings in loading and unloading operations. The author specifically attacks the practices of not quickly "turning around", only partly loading cars and failure to adequately maintain spur tracks under control of military units. The statement is made that most cars available for military use are of the four axle, 60 ton capacity type.</p> |                                                                |                                                                       |
| 5                | 6            | 31-32 | Komsomol'tsy - Pravoflangovye BAMA                                                                                                                                                                                                                                                                                                                                                  | (Members of Komsomol - Right Flankers of the BAM)              | Lt. Col. I. Sukhov<br>Lt. Col. A. Filimorrov                          |
|                  |              |       | <p>Article describing unstinting efforts of soldiers/komsomolniks in building the BAM.</p>                                                                                                                                                                                                                                                                                          |                                                                |                                                                       |
| 6                | 7            | 13-19 | Voiny - Zheleznodorozhniki Na Stroikakh Strany                                                                                                                                                                                                                                                                                                                                      | (Soldiers - Railroaders in the Building of the Country)        | Lt. Gen Ia. Maiorov, Chief of Political Directorate of Railway Troops |

This article is mostly concerned with the construction of BAM and efforts to increase productivity through heightened "socialist competition". The author makes the statement, "In participating in construction (of railroads) the personnel

| Reference Number | Issue Number | Pages | Title                                                                                                                                                                                                                                                                                                                                              | (Translated Title)                                 | Authors        |
|------------------|--------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|----------------|
|                  | (Cont'd)     |       | Voiny - Zheleznodorozhniki Na Stroikakh Strany                                                                                                                                                                                                                                                                                                     |                                                    |                |
|                  |              |       | simultaneously fulfill the requirement for heightened military readiness, and achievement of military and special skills." In referring to working around the clock under difficult conditions while building the BAM, General Maiorov notes with satisfaction that this is training "under conditions as close as possible to battle conditions." |                                                    |                |
| 7                | 8            | 76-78 | Soderzhanie i Obsluzhivanie Zheleznodorozhnykh Pod'ezdnykh Putei                                                                                                                                                                                                                                                                                   | (Maintenance and Servicing of Railway Spur Tracks) | Maj. Chekmarev |
|                  |              |       | The article stresses the need to maintain all spur lines in readiness for military cargo transfer. The author suggests, without saying so, that this is a problem area. He particularly stresses the need to repair winter damage to the roadbed each spring.                                                                                      |                                                    |                |
| 8                | 8            | 87-90 | Voiny Zheleznodorozhniki Shturmuiut Vekovuiu Taigu                                                                                                                                                                                                                                                                                                 | (Soldiers - Railroaders Storm the Ancient Taiga)   | M. Chizhikov   |

Description of construction of BAM highlighting problems of construction and the heroic efforts involved in overcoming them.

NOTE: There was no article in the August issue (No. 8) commemorating All Union Railroad Workers' Day which was 3 August 1975.

| Reference Number | Issue Number | Pages | Title                                                           | (Translated Title)                                                 | Authors                                                     |
|------------------|--------------|-------|-----------------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| 9                | 9            | 47-49 | Most na Trasse BAMA                                             | (A Bridge on the Route of the BAM)                                 | Capt. V. Glazkov                                            |
| 10               | 10           | 88-90 | Ekonomicheskaia Rabota Ofitserov Zheleznodorozhnoi Komendaturny | (Economic Work of the Officers of the Railway Commandant's Office) | Col. S. Fedorov, Lt. Col. Iu. Nesterov, Maj. S. Golovchanov |

The article describes the construction of a bridge on the BAM. The author makes the statement that in building the BAM, the railway troops are honoring the memory of the defenders of the motherland, presumably during World War II.

This interesting article pertains to the operations of military officers engaged in organizing and terminating shipments on the railroad system. The article implies without specific statement that military shipment on railways is widespread, routine and handled by military officers rather than clerks working for the railways. The authors describe a book which they have written to assist officers "responsible" for rail shipments. Mention is made of the necessity to provide guards for many of the shipments.

| Reference Number | Issue Number | Pages | Title                       | (Translated Title)                        | Authors       |
|------------------|--------------|-------|-----------------------------|-------------------------------------------|---------------|
| 11               | 10           | 25-27 | Truditsia na BAM - Komsomol | (The Members of Komsomol work on the BAM) | Maj. G. Berik |

A short article extolling the virtues of young people heroically applying the principles of "socialist competition" to construction of the BAM. All those concerned seem to be members of the Komsomol.

#### FOOTNOTES

1. Graham Turbiville, "Soviet Logistic Support for Ground Operations", article appearing in RUSI, Journal of the Royal United Services Institute for Defense Studies, Whitehall, London. Volume 120, No. 3, September, 1975, pp. 63-69.

2. Jesse W. Miller, Jr., "'Long War Hedge' Is Wise Stand in Central Europe." Article appearing in Army magazine published monthly by the Association of the US Army, Washington, D.C., Volume 25, No. 11, November, 1975, pp. 55-56.

3. Turbiville, op. cit., p. 69.

4. See, for example, General Gunther Blumentritt's commentary in The Fatal Decisions, edited by Seymour Freiden and William Richardson, William Sloane Associates, New York, 1956. The characterization of Moscow as the "focal junction" of the Russian rail network on page 50 is particularly to the point. General Blumentritt served as Field Marshal Von Kluge's Chief of Staff from 1940 to 1942. During this period, Von Kluge commanded the 4th Army which conducted the main German attack on Moscow.

5. All figures are adapted from Transport i Sviaz SSSR, Statisticheskii Sbornik, 1972, (Transport and Communications Statistical Collection - 1972) published by the Central Statistical Directorate, Moscow, 1972.

6. Kalendar Voina 1975, (The Soldiers' Calendar - 1975) published by the Ministry of Defense, Moscow, 1974, p. 257.

7. Leo Heiman, "Soviet Invasion Weaknesses", published in Military Review, August, 1969, p. 42. Leo Heiman is a noted Israeli correspondent, who once served in the Soviet Army.

8. Turbiville, op. cit., p. 69.

9. The obvious supposition is that this 1917-1966 rail net was the one in existence at the outbreak of World War II. That this was, in fact, true is borne out by numerous maps of the World War II era which depict the then existing rail net. The excellent set of maps included in a packet on the rear cover of Volume Three of Istoriia Vtoroi Mirovoi Voiny 1939-1945. (History of the Second World War 1939-1945), Voenizdat, Moscow 1974; are a case in point.

10. Atlas Ckhem Zheleznykh Dorog SSSR (Schematic Atlas of the Railroads of the USSR), Main Directorate of Geodasy and Cartography under the Council of Ministers of the USSR, Moscow, 1974, especially p. 2.

11. For example see "Stal'nye Dorogi Strany" (The Steel Roads of the Country), Pravda, 3 August 1975, p. 1.

12. Holland Hunter, Soviet Transport Experience, The Brookings Institute, Washington, D.C., 1968, p. 9.

13. Transport i Sviaz - 1972, op. cit., p. 89 and 94.

14. These factors are essentially the closer spacing (hence greater number) of substations required and the heavier catenary structure required to deliver the required wattage at the reduced voltage. The first factor constitutes a liability in that the destruction of any one substation creates a gap which cannot be traversed by electric locomotives. The second factor is a liability because repair work is more difficult and time consuming. For a discussion of the relative merits of direct current and alternating current railway electrification phrased in layman's terminology see William D. Middleton, When the Steam Road Is Electrified, Kalmbach Publishing Co., Milwaukee, 1974. The chapter entitled "The Technology of Electrification" is most useful.

15. N. I. Sidorov, Kak Ustroen i Rabotaet Elektrovoz (How the Electric Locomotive is Built and Works), Transport, Moscow, 1974, pp. 3-4.

16. Transport i Sviaz - 1972, op. cit., p. 90.

17. Soviet Transport Experience, op. cit., p. 180.

18. This is an earlier edition of the book often cited in this paper. The practice of the Central Statistical Directorate is apparently to publish a statistical summary of each Five Year Plan, the publication of the volume occurring about two years after the end of the plan.

19. Transport i Sviaz - 1972, op. cit., p. 106.

20. A. D. Belenkii and V. A. Sokolov, Trebovaniia K Teplovozam s Uchetom Klimaticheskikh Uslovii Ikh Raboty (Demands on Diesel Locomotives with Respect to the Climatological Conditions of Their Work), printed in Zheleznodorozhnyi Transport, Moscow, January, 1975, p. 49.

21. See "S Markoi Kolomenskogo Zavoda" (With the Trademark of the Kolomenskii Factory) in Nauka i Zhizn' (Science and Life), Moscow, February, 1975, pp. 3-12, for a discussion of the problems involved.

22. V. N. Tveritin, "Problemy Nadezhnosti Teplovozov" (Problems of Reliability of Diesel Locomotives), printed in Zheleznodorozhnii Transport, Moscow, January, 1975, pp. 53-54.

23. The construction goals for diesel locomotives during the 10th Five Year Plan were listed in the 14 December, 1975 issue of Krasnaia Zvezda, p. 4 as: 6,400 diesel main line units, and 2,500 diesel switchers. The goal for electric locomotives is 2,200.

24. "Teplovoz - Iubilar" (The Jubilee Diesel), Tekhnika Molodezhi (Technology for Youth), Moscow, January, 1976, p. 47.

25. Figures taken from Pennsy Power II by Alvin Stauffer and Bert Pennypacker, Medina, Ohio, 1968, p. 201.

26. An example of this would be the article entitled "Berech' Vagony" appearing in Pravda, 25 May, 1970, p. 4, which states that the average freight car receives some kind of running maintenance 580 times a year, and the difference between train speed (teknicheskaiia skorost') and speed over a division (uchastkovaia skorost') which is given as a ratio of about 4 to 3 in several sources; Transport i Sviaz 1972, p. 104, for example. The former is a clear cut example of freight car non-reliability, while the latter shows the problems of flexibility and reliability with respect to the physical plant, signaling and dispatching systems.

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3. Hunter, Holland. Soviet Transport Experience, The Brookings Institute, Washington, D. C., 1968, Numerous references.
4. Kalendar Voina 1975. (The Soldier's Calendar 1975), published by the Ministry of Defense, 1974.
5. Krasnaia Zvezda (Red Star). Daily newspaper published by the Ministry of Defense, Moscow. Numerous articles; see Annex A, 1 January to 31 December, 1975.
6. Middleton, William D. When the Steam Road is Electrified, Kalmbach Publishing Co., Milwaukee, USA, 1974.
7. Military Review. Published by the US Command and General Staff College, Fort Leavenworth, Kansas.
8. Miller, Jesse W. Jr. "Long War Hedge is Wise Stand in Central Europe", Army Magazine, monthly journal published by the Association of the US Army, Washington, D.C., November, 1975.
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