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№ 87

Economic Intelligence Report

PETROLEUM PIPELINE TRANSPORT FROM THE USSR TO POLAND, EAST GERMANY, CZECHOSLOVAKIA, AND HUNGARY 1960–65

CIA/RR ER 62–20

June 1962

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

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FOREWORD

During the period of the Seven Year Plan (1959-65) the USSR expects to double its exports of crude oil to Poland, East Germany, Czechoslovakia, and Hungary. In order to transport this crude oil at the lowest possible cost and to relieve the demand on other modes of transportation, a pipeline is being constructed from the petroleum-producing area near Kuybyshev in the USSR to refineries in these four European Satellite countries.

This report attempts to assess the investment in money and materials that will be required to construct the pipeline, to evaluate the impact of the pipeline on other modes of transportation, to compare the cost of pipeline transport with other modes of transportation, and to give some indication of the economic and strategic significance of the pipeline.

CONTENTS

Appendixes

Page

Tables

Map

PETROLEUM PIPELINE TRANSPORT FROM THE USSR TO POLAND, EAST GERMANY, CZECHOSLOVAKIA, AND HUNGARY* 1960-65

Summary and Conclusions

A petroleum pipeline system is under construction that extends from the principal petroleum-producing area in the USSR, near Kuybyshev, to refineries in Poland, East Germany, Czechoslovakia, and Hungary. The entire system is scheduled for completion by the end of 1963 and probably will be put into operation in 1964. The pipeline is designed to deliver about 23 million metric tons** of crude oil per year to these four countries when all pumping facilities are installed. This amount is well above the refinery capacity that will exist in these countries in 1963 and exceeds the 15 million tons of Soviet crude oil planned for export by pipeline to these countries in 1965. It is probable, therefore, that initial operation of the pipeline will employ sufficient pumping facilities to supply refineries through 1965 and that additional pumping facilities will be installed thereafter to bring the system up to its full capacity when new refineries that are now under construction are completed, probably in 1968.

This project, which is under the auspices of the Council for Mutual Economic Assistance (CEMA), probably is the most ambitious single economic project ever to be undertaken jointly by members of the Soviet Bloc. Construction of the pipeline will require an investment of between $300 million*** and $500 million, 80 percent of which will be invested in the Soviet sections.

The pipeline will be about 3,750 kilometers (km) in length, 2,550 km of which will be in the USSR. It is estimated that about 725,000 tons of pipe will be required for the project. Progress on construction in the Satellites† has been rapid, but delays have occurred in the Soviet section, where there has been some difficulty in obtaining large-diameter pipe.

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* The estimates and conclusions in this report represent the best judgment of this Office as of 1 May 1962.

** Unless otherwise indicated, tonnages are given in metric tons throughout this report.

*** Unless otherwise indicated, dollar values are given in current US dollars throughout this report.

† Unless otherwise indicated, the term Satellites in this report refers to Poland, East Germany, Czechoslovakia, and Hungary.

Completion of the pipeline system probably will terminate the transportation of crude oil by railroad from the USSR to the four Satellites, at least through 1965, and will certainly reduce this movement by railroad from East German and Polish seaports to the Satellite refineries. The increase in refined products in the Satellites will cause an increased demand for internal transport there.

The transportation of at least 15 million tons of crude oil by railroad from the Soviet oilfields to the Satellite borders (a distance of about 2,100 km) would require the continuous employment of about 16,100 Soviet tank cars. This figure is believed to be the minimum number of tank cars required under the most optimum conditions, with tank cars moving at a speed of 300 km per day and allowing only 1.75 days for loading, unloading, terminal handling, and switching en route. In addition, 6,800 more cars would be required to complete the haul from the Satellite border to the refineries. This total of 22,900 tank cars, representing an investment of about $260 million, is more than 50 percent of the estimated maximum cost of constructing the pipeline.

A comparison of the estimated costs of pipeline transport with those of any other mode of transportation from Kuybyshev to the Satellite terminals at current rates shows that pipeline costs are lower by 75 to 80 percent. If the volume of crude oil movement by pipeline planned for 1965 is achieved, the saving in annual transportation expenditures to the Satellites by use of pipeline rather than rail transport will enable these countries to recover their investment in pipeline construction in a remarkably short period of time. The rate at which the USSR will be able to recover its investment is less clear because, although it is more likely to retain its substantial savings in transportation expenditures, it might decide to pass them along to the Satellites in the form of lower prices for Soviet crude oil.

There is no evidence that the pipeline is intended for any other purpose than the supply of crude oil to the Satellites. The pipeline system will increase the supply of military fuel available in Eastern Europe and, by relieving the railroads of the burden of carrying the crude oil, will improve their capability to carry other economic and strategic materials.

I. Introduction

In December 1958, at the tenth session of the Council for Mutual Economic Assistance (CEMA), which was held in Prague, Czechoslovakia, an agreement was concluded by the USSR, Poland, East Germany, Czechoslovakia, and Hungary to construct a crude oil pipeline system to connect the oilfields in the Urals-Volga region of the USSR with refineries in the four Satellite countries concerned. The movement of petroleum through this pipeline system is expected to total about 15 million tons per year by 1965.

The principal reasons given as justification for the pipeline system are the increasing demand for petroleum in the Satellites, the high costs of railroad transport, and the desire to create a petrochemical industry in the Satellites. Completion of the pipeline will make available to the Satellites increasing quantities of low-priced oil that will vie with coal as a primary source of energy. The effects on the future development and exploitation of other modes of transportation, particularly railroad transport, are significant and probably will be beneficial to all countries concerned. The Satellites, however, will have increased their economic and political dependence on the USSR.

II. Planned Development of Pipeline Transport

A. Demand for Petroleum

Between 1955 and 1960 the USSR increased its production of petroleum by nearly 110 percent. Domestic consumption, however, increased by only 70 percent, thus creating a considerable surplus of petroleum for export. In the Satellites the situation is reversed. The rapid rate of industrialization and the growing importance of petroleum as a primary source of energy have necessitated the importation of petroleum in increasing amounts. With the exception of Rumania and Albania, the European Satellite countries are dependent on outside sources for their major supply of crude oil. Poland, East Germany, Czechoslovakia, and Hungary obtain the preponderance of their supply from the USSR. Soviet exports of crude oil to these four countries in 1955 amounted to 1.7 million tons and in 1959 to 5.3 million tons. By 1965, Soviet exports of crude oil to these four countries by pipeline are expected to reach about 15 million tons, or about 88 percent of the total imports of crude oil planned by those countries for 1965 (see Table 1*).

The origin of the 2.1 million tons of crude oil to be imported in excess of the imports from the USSR is not clear. Rumanian plans

* Table 1 follows on p. 4.

through 1965 do not provide for the export of crude oil to any other Satellites. It is entirely possible that the 2.1 million tons also will come from the USSR, although both Albania and Austria have supplied crude oil to these countries in the past.

Table 1

Planned Production and Imports of Crude Oil
in Poland, East Germany, Czechoslovakia, and Hungary
1965

Million Metric Tons

Country	Planned Domestic Production	Imports	Total
Poland	0.2	3.1	3.3
East Germany	1.0	5.0	6.0
Czechoslovakia	0.2	6.0	6.2
Hungary	2.2	3.0	5.2
Total	3.6	17.1	20.7

50X1

50X1

50X1

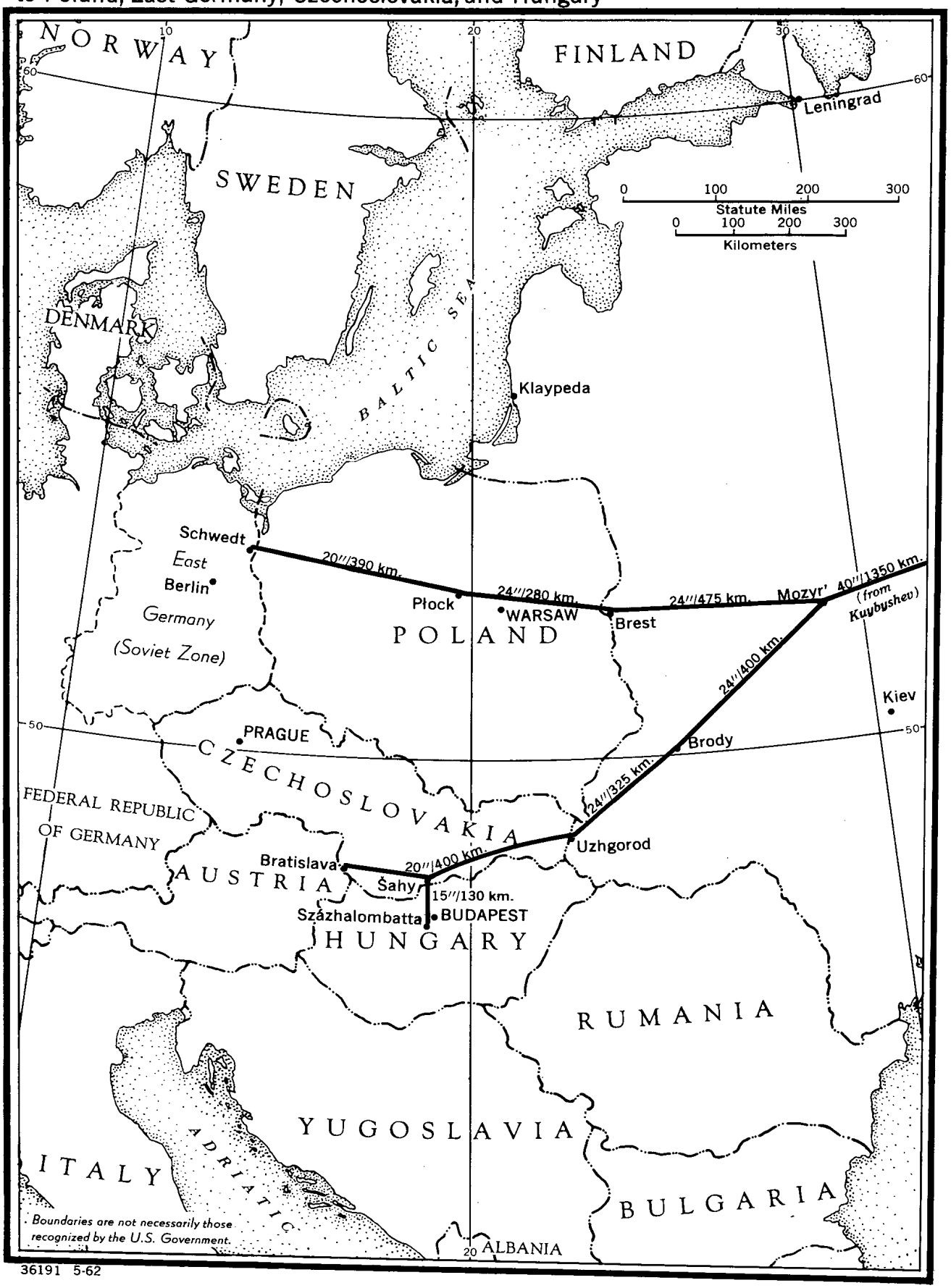
B. Route and Characteristics of the Pipeline System*

The pipeline system now under construction will originate at Kuybyshev in the Urals-Volga producing area of the USSR and will extend westward to Mozyr'. At Mozyr' the line separates into two branches, one of which will run through Brest to Plock in Poland and terminate at Schwedt in East Germany on the west bank of the Oder River. The other branch will run through Brody to Uzhgorod on the Czechoslovak border and thence westward to Sahy, Czechoslovakia. At that point it separates into two spurs, one of which will terminate at Bratislava, Czechoslovakia, and the other at Szazhalombatta, near Budapest, Hungary.** This pipeline system has been designed exclusively for the movement of crude oil. The

* See the map, following p. 4, and Table 2, which follows on p. 5.
** Hungary also plans to construct a short 18-km link to connect this pipeline with an existing line that serves a small refinery at Szony near Budapest.

50X1

CRUDE OIL PIPELINE SYSTEM FROM THE USSR
to Poland, East Germany, Czechoslovakia, and Hungary



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principal characteristics of each of the sections of the pipeline system are shown in Table 2.

Table 2

Estimated Carrying Capacity of the Pipeline System Connecting the USSR with Poland, East Germany, Czechoslovakia, and Hungary [redacted] 50X1

Route	Length (Kilometers)	Diameter (Inches)	Carrying Capacity b/ (Million Metric Tons per Year)
Kuybyshev-Mozyr'	1,350	40	45 to 50
Mozyr'-Brest	475	24	11.5
Brest-Plock	280	24	11.5
Plock-Schwedt	390	20	7.5
Mozyr'-Uzhgorod (via Brody)	725	24	11.5
Uzhgorod-Bratislava (via Sahy)	400	20	7.5
Sahy-Szazhalombatta	130	15	3.0
Total	3,750		

[redacted] 50X1

b. The carrying capacity of the 40-inch section is tonnage that the USSR claims will be pumped through the line when all pumping stations are installed. [redacted] The capacities of all the other sections are the capacities for which pipelines of the diameters shown are normally designed and utilized in the USSR. [redacted] 50X1 50X1

In actual practice the capacity of a crude oil pipeline system depends on a number of factors, including the diameter of the pipe, the capacity and spacing of pumping stations, and the temperature and viscosity of the crude oil. The capacities shown in Table 2 are well below the throughput delivery practices in the US for pipelines of equal diameter. [redacted] Therefore, the pipeline system under construction probably will be adequate for transportation of the 15 million tons of crude oil planned for export to the four Satellites in 1965. 50X1

It is planned that the entire pipeline system will be completed by the end of 1963, but the system probably will not be put into operation

until sometime in 1964. The scheduled completion dates, by section, are as follows [redacted]: 50X1

Pipeline Section	Completion Date
Kuybyshev-Mozyr'*	1963
Mozyr'-Brest	1963
Brest-Plock	1963
Plock-Schwedt	1963
Mozyr'-Uzhgorod (via Brody)	1963
Uzhgorod-Bratislava** (via Sahy)	1961
Sahy-Szazhalombatta	1962

Construction of the sections in the Satellites appears to be on schedule. The section from Brody in the USSR to Bratislava, Czechoslovakia, was completed in October 1961 and placed in operation in January 1962. For the present, railroad tank cars will transport crude oil to the eastern terminus at Brody, at which point the crude oil will be transferred to the pipeline system. By the end of 1961, more than 70 km of the Hungarian section had been completed, and construction was progressing at the rate of 1 km per day. More than 200 km of the Polish section had been completed by the end of 1961. Three construction crews are working on the Polish section, and they plan to complete 300 km in 1962. Very little construction is required in East Germany, and there is no evidence that construction has been started, although dual, 20-inch pipes have been laid across the Oder River. Information on the amount of progress on the Soviet sections is not available. Moreover, there is no evidence that construction has yet been started on the 40-inch section from Kuybyshev to Mozyr', although considerable construction is planned during 1962.

In order to process the planned increase in imports of crude oil, the four Satellites are constructing new refineries or, as in Czechoslovakia, increasing the capacity of existing refineries at the western

* In addition to the Satellite network, a pipeline is being laid at the same time from Unecha (in the USSR on the Kuybyshev-Mozyr' line) north to a refinery at Polotsk, thence to Klaypeda in the Lithuanian SSR. Another line, from Polotsk to Ventspils, in the Latvian SSR, is proposed and may be under construction. Both Klaypeda and Ventspils are ports on the Baltic Sea, permitting export of crude oil by sea, especially to the Scandinavian countries.

** It has been proposed that eventually the Czechoslovak sector be extended from Bratislava to refineries in the western part of that country, including Pardubice, Kolin, and Kralupy.

terminals of the pipeline system. The location and planned capacities of the new refineries are as indicated in Table 3.

Table 3

New Refineries Under Construction
in Poland, East Germany, Czechoslovakia, and Hungary
1965 and 1968

Location	Million Metric Tons of Planned Capacity	
	1965	1968
Plock, Poland	2	6
Schwedt, East Germany	4	8
Bratislava, Czechoslovakia	5	5
Szazhalombatta, Hungary	2	3
Total	13	22

The annual capacity of refineries currently in operation in these countries is about 10 million tons. This existing capacity, together with the 13 million tons of new capacity indicated in Table 3, would result in a total of 23 million tons of capacity in 1965, which will be more than adequate to process the domestic production and imports of crude oil planned for 1965.

C. Investment Costs

The total cost of construction of the 3,750-km pipeline system is estimated to be between $300 million and $500 million, distributed by section as shown in Table 4.* This estimate is based on an arbitrary assumption that the cost of construction in the Soviet Bloc will be similar to the cost of construction in the US but will not be more than the cost of construction in the USSR. The average cost of construction of 1 mile of pipeline of all sizes constructed in the US during 1960 was $100,000 per mile (about $62,000 per kilometer), including the cost of pipe. In the USSR in 1957 the cost of construction, including pipe, was about 365,000 rubles** per kilometer for a 15-inch line, 560,000 rubles per kilometer

* Table 4 follows on p. 8.

** In 1957 prices. Unless otherwise indicated, all values are given in old rubles (before the 1961 currency reform). The ruble-dollar ratio in the construction field is about 7 to 1. All values relating to construction are converted at this rate, and all other values are converted at the rate of exchange of 4 rubles to US $1.

Table 4

Investment in Construction of the Pipeline
Connecting the USSR with Poland, East Germany, Czechoslovakia, and Hungary
by Section

Pipeline Section	Length (Kilometers)	Diameter (Inches)	Cost (Thousand US $) Per Kilometer a/ Minimum	Per Kilometer a/ Maximum	Total b/ Minimum	Total b/ Maximum	Percent of Total Maximum Cost
USSR							
Kuybyshev-Mozyr' c/	1,350	40	137	209	184,950	282,150	57.4
Mozyr'-Brest	475	24	62	94	29,516	44,650	9.1
Mozyr'-Uzhgorod	725	24	62	94	45,049	68,150	13.9
Subtotal	2,550				259,515	394,950	80.4
European Satellites							
Brest-Plock (Poland)	280	24	62	94	17,398	26,320	5.4
Plock-Schwedt (Poland d/)	390	20	62	80	24,234	31,200	6.4
Uzhgorod-Bratislava (Czechoslovakia)	400	20	62	80	24,855	32,000	6.4
Sahy-Szazhalombatta (Hungary)	130	15	52	52	6,760	6,760	1.4
Subtotal	1,200				73,247	96,280	19.6
Total	3,750				332,762	491,230	100.0

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b. Maximum and minimum material and construction-installation costs multiplied by kilometers of line to be installed. Total investment costs for construction of the pipeline are based on unrounded data.
c. The section from Kuybyshev to Mozyr' will serve Soviet refineries and seaports as well as those of the European Satellites.
d. Although all but 25 to 30 km of this section of pipeline are in Poland, the pipeline serves East Germany exclusively.

for a 20-inch line, and 660,000 rubles per kilometer for a 24-inch line. [redacted] These costs would represent about $52,000, $80,000, and $94,000 per kilometer for 15-inch, 20-inch, and 24-inch pipelines, respectively. About 80 percent of the total cost of construction will be invested in the 2,550 km of line within the USSR, and 20 percent will be invested in the four Satellites concerned. 50X1

It has been claimed that this investment, the largest single investment project ever undertaken by CEMA, [redacted] will be recovered within a few years of operation because of the substantial savings in transportation costs compared with the principal alternative mode of transportation, the railroad.* Each country is to construct, own, and operate that portion of the pipeline crossing its territory and will charge transit fees for all petroleum flowing through that portion en route to another country. 50X1

East Germany has been called on to assist Poland by providing a loan to finance all of the construction of the 390-km section from Plock to Schwedt. [redacted] Although that section is on Polish territory, it will serve East Germany exclusively, and presumably Poland has balked at the initial outlay of funds from which it will realize no immediate return. East Germany also will assist Poland in financing the construction of the 280-km section from Brest to Plock, the justification being that the line would have been smaller and less costly if it had been planned to be used only by Poland. [redacted] The loan for both sections will be repaid over a 10-year period, partly in goods and partly in reduced charges for transportation of petroleum through the line. [redacted] It is possible tha similar arrangements have been made between Czechoslovakia and Hungary, as a large portion of the line that will serve Hungary runs through Czechoslovakia. Moreover, as the over-all project is sponsored by CEMA, it is entirely possible that the USSR is providing some financial aid to all of the four Satellites, although there is no definite evidence of this assistance. The lack of more accurate cost data precludes a more definitive analysis of the investment program for this project. Considering the large volume of crude oil to be transported, however, the reduction in transportation costs compared with costs by other modes of transportation and the investment that would be required in other modes of transportation if the pipeline were not constructed, there is little doubt that this financial venture is sound and that funds will be made available. 50X1 50X1 50X1

It is estimated that the cost of pipe for the entire system will amount to about $200 million, which represents about 40 percent of the estimated maximum investment in the pipeline. The cost of 15-inch pipe is estimated to be about $240 per ton, and the cost of 20-inch and 24-inch

* See IV, p. 16, below, and Table 8, p. 20, below.

pipe is estimated to be $245 and $250 per ton, respectively.* The cost of 40-inch pipe is estimated to be about $300 per ton. The total pipe required and the estimated cost thereof, by section, are shown in Table 5.**

D. Availability of Pipe

The procurement of pipe constitutes a major problem because there is not sufficient production capacity within the Bloc to provide the amount needed for this pipeline and at the same time to provide all that is needed for other projects such as gasline construction in the USSR. None of the Bloc countries has produced 40-inch pipe in the past. In November 1961, however, the first 40-inch pipe mill in the USSR began operating on a limited basis. In an effort to solve the problem of procurement of pipe of all dimensions, the USSR has contracted with Italy, Japan, Sweden, and West Germany. During 1959-61, West Germany delivered 475,000 tons of 40-inch pipe to the USSR, about 100,000 tons of which were delivered during 1961. [redacted] Another order for 230,000 tons has been placed with West Germany for shipment during 1962. [redacted] During 1961, Sweden shipped 3,000 tons of a 135,000-ton order for 40-inch pipe, the remainder of which is scheduled for shipment during 1962-63. [redacted] Italy has a firm order for 180,000 tons of 40-inch pipe that is scheduled for delivery to the USSR during 1962-63. [redacted] During 1961 the Satellites produced about 240,000 tons of pipe of 16-inch diameter and larger. East Germany alone is capable of producing 20,000 tons of 20-inch pipe per year, which represents about two-fifths of the requirement for the section of pipeline from Plock to the East German refinery at Schwedt. Poland is known to be importing 24-inch pipe from the Phoenix-Rheinrohr Company of West Germany. The Czechoslovak section of the pipeline has been completed, and although Czechoslovakia is capable of producing both welded and seamless large-diameter pipe, significant quantities have been purchased from West Germany. Hungary also is importing pipe of 14-inch to 15-inch diameter from West Germany. There is no evidence that the procurement of pumping equipment will be a significant problem in this construction project.

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III. Probable Effects of the Pipeline on Other Modes of Transportation

A. General

The net effect of the movement of crude oil by pipeline on other modes of transportation is not entirely clear. On the one hand, the movement of crude oil from the USSR to the four Satellites by any mode of

* Japan has quoted the USSR a price of $245 per ton for 20-inch pipe and $250 per ton for 28-inch pipe. [redacted] 50X1

** Table 5 follows on p. 11.

Table 5

Requirements of Pipe for the Pipeline
Connecting the USSR with Poland, East Germany, Czechoslovakia, and Hungary
by Section

Pipeline Section	Length (Kilometers)	Inches		Requirements (Metric Tons)		Cost		
		Diameter	Gauge	Amount per Kilometer a/	Total Amount	Per Metric Ton b/ (US $)	Per Kilometer (US $)	Total (Million US $)
USSR								
Kuybyshev-Mozyr'	1,350	40	0.500	308	415,800	300	92,400	124.7
Mozyr'-Brest	475	24	0.375	141	66,975	250	35,250	16.7
Mozyr'-Uzhgorod	725	24	0.375	141	102,225	250	35,250	25.6
Subtotal	2,550				585,000			167.0
European Satellites								
Brest-Plock	280	24	0.375	141	39,480	250	35,250	9.9
Plock-Schwedt	390	20	0.375	117	45,630	245	28,665	11.2
Uzhgorod-Bratislava	400	20	0.375	117	46,800	245	28,665	11.5
Sahy-Szazhalombatta	130	15	0.281	61	7,930	240	14,640	1.9
Subtotal	1,200				139,840			34.5
Total	3,750				724,840			201.5

a. Figures are [redacted] converted to metric measurement.
b. Estimated.

50X1

transportation other than pipeline probably will cease entirely by 1963, on completion of the pipeline, and will not be required through 1965. By 1965 the pipeline will be capable of delivering at least 15 million tons of crude oil annually, and the planned export of Soviet crude oil through 1965 to these countries by pipeline is only 15 million tons. Therefore, the USSR will feel the effects immediately on completion of the line in diminished demands on railroad and sea transport for the movement of crude oil to the European Satellites.

Demands on the inland transport system of the Satellites will increase. Although the long haul of crude oil by rail from the Soviet-Satellite borders and from seaports will be eliminated, the growing reliance of the Satellites on petroleum as a source of energy will generate an increase in demand for the transportation of refined petroleum products.

In 1959, about 5.3 million tons of crude oil were exported by the USSR to the four Satellites participating in the pipeline project. About 1 million tons were transported by sea to East Germany and Poland through the Bosporus, about 0.5 million tons were moved by inland waterway to Czechoslovakia and Hungary via the Danube River, and about 2.8 million tons were carried by railroad from the USSR. The balance of Soviet exports (1 million tons) was actually shipped from Austria to the Satellites under the terms of the Soviet-Austrian reparations agreement.

B. Sea Transport

Although the cost per ton-kilometer by pipeline transport is about twice the cost by sea transport, the circuitousness of the Black Sea route plus the sizable overland haul at both ends makes it probable that the maritime haul of crude oil will be discontinued on completion of the pipeline in 1963 and that it will not be required to satisfy the planned demand for crude oil through 1965. The estimated cost by pipeline from Kuybyshev to Plock will be $5.26 per ton compared with an expenditure of $25.65 per ton by a combination of rail-sea-rail transport.* The elimination of this sea carriage will release Bloc tankers, thereby improving the competitive position of the Bloc in the sale and delivery of Soviet crude oil and other petroleum products to other markets.**

The movement of petroleum by sea to East Germany and Poland also requires an overland routing from the ports because present and planned

* For a comparison of expenditures for various modes of transportation, see Table 8, p. 20, below.
** Nine tankers of 18,000 deadweight tons each in continuous operation would be required to transport 1 million tons of crude oil from Odessa to East German or Polish ports.

locations of refineries are inland. Thus availability of the pipelines also would relieve the railroad systems of the crude oil traffic associated with the seaborne movement.

C. Inland Water Transport

The movement of crude oil from the USSR by inland water transport probably will cease, at least through 1965, as the capacity of the pipeline that will serve Czechoslovakia and Hungary will be adequate to deliver the imports planned for 1965. Moreover, the cost of transporting crude oil by a combination of railroad and inland water services from Kuybyshev to the refineries in Czechoslovakia and Hungary exceeds the cost of pipeline transport by a considerable margin (about five to one). Another reason for avoiding the use of inland water transport is the fact that it is not a dependable mode of transportation if an even flow of crude oil is required. Navigation on the Danube River is interrupted by ice about 40 days annually, usually during January and February, and by low-water conditions during the late summer and fall.

On completion of the pipeline, Bloc river tank barges can be released for use in transporting Soviet crude oil, and petroleum products as well, to Austria and West Germany, thus improving the competitive position of the USSR in the sale and delivery of petroleum to the Western European market.

D. Railroad Transport

1. General

The effect of completion of the pipeline on the railroad systems of all countries participating in the pipeline program will be far more significant than the effect on other modes of transportation. The movement of crude oil by railroad from the USSR to the four Satellites probably will cease entirely, at least through 1965, and the movement of crude oil by railroad from East German and Polish seaports to the refineries also probably will cease or certainly will be reduced. An increase in the volume of refined products in the Satellites will result in an increased demand for internal distribution on railroad transport services there. Additional tank cars will be required as well as other equipment and facilities.

2. USSR

On completion of the entire pipeline system the railroads of the USSR will be the first to realize an absolute reduction in demand for services. In 1959, for example, the Soviet railroads carried 2.8 million tons of crude oil to the four Satellites, and the Soviet railroads performed a minimum of 5.6 billion ton-kilometers (tkm) in delivering crude

oil to the European Satellite borders for onward transportation by railroad. In addition, 1 million tons were delivered to Black Sea ports for onward transportation by sea. The railroad distance from Kuybyshev to Odessa* is about 2,000 km, resulting in 2 billion ton-kilometers. To accomplish this movement, it is estimated that the continuous employment of 3,900 tank cars with a capacity of 40 tons each was required.** On completion of the pipeline, this demand on the Soviet railroad system will cease.

In addition to crude oil the USSR in 1959 exported 1.4 million tons of petroleum products to the four Satellites. The exact distance that these products moved by railroad within the USSR is not clear, but it is probable that a rail haul was involved, whether the products were delivered to seaports or to the Soviet-Satellite borders. Because many of the petroleum refineries in the USSR are located in the areas of production of crude oil, the average length of haul is high,*** resulting in delayed turnaround time for tank cars. It is estimated that 1,140 tank cars in addition were required to transport the 1.4 million tons of petroleum products.** On completion of the pipeline and the Satellite refineries that the pipeline will serve, this movement also may cease, as these products will be refined in the Satellites.

In summary, therefore, putting the pipeline into operation will release about 5,040 tank cars, or about 4.5 percent of the current tank car inventory in the USSR, and thus will reduce the shortage of tank cars in the USSR. These cars may be used for internal distribution in the USSR or for delivery to seaports, thus improving the ability of the USSR to deliver its exportable surplus to the other world markets.

By 1965 the USSR plans to export at least 15 million tons of crude oil to the Satellites. To move that tonnage by rail to the Soviet-Satellite borders or to the Black Sea ports would require more than 16,100 tank cars, or about 12 percent of the planned inventory of Soviet tank cars in 1965.† The investment required to build these tank cars for use in Satellite traffic alone would amount to about 724 million rubles†† ($181 million), or about 45 percent of the estimated maximum cost of constructing the Soviet section of the pipeline as outlined in Table 4.†††

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* Although other Black Sea ports may have been used, the difference in rail distance would be negligible.

** See the methodology, Appendix A.

*** The average length of haul for petroleum products in the USSR is 1,367 km.

† It is estimated that 140,000 tank cars will be required in the USSR in 1965, provided that all planned pipeline construction is completed.

†† Estimated to be 45,000 rubles per tank car.

††† P. 8, above.

3. European Satellites

The effect of the pipeline on the railroad system in the Satellites will be somewhat different from that in the USSR. It is probable that the planned import of 15 million tons from the USSR in 1965 will move entirely by pipeline, thereby eliminating the long overland haul from the Soviet-Satellite borders. Although the refineries at which the pipelines will terminate will have a capacity of only 13 million tons in 1965, it is believed that the 2 million tons above new refinery capacity will be distributed from the pipeline terminals to other refineries. Both Czechoslovakia and Hungary will have sufficient refinery capacity to absorb the additional tonnage. It is probable, therefore, that pipeline deliveries in 1965 will be as shown in Table 6.

Table 6

Estimated Deliveries of Crude Oil by Pipeline from the USSR to Poland, East Germany, Czechoslovakia, and Hungary 1965

Million Metric Tons

Recipient Country	Amount
Poland	2
East Germany	4
Czechoslovakia	6
Hungary	3
Total	15

Transportation of this amount of crude oil by railroad from the Soviet-Satellite borders to the Satellite refineries would require about 6,800 railroad tank cars distributed as follows: Poland, 800; East Germany, 2,300; Czechoslovakia, 2,600; and Hungary, 1,100. At an estimated cost of 45,000 rubles per tank car ($11,250), this would represent an investment of about $77 million, or about 80 percent of the cost of constructing the Satellite sections of the pipeline.

The Satellite plans for the import of crude oil beyond 1965 are not available. Refinery capacity in these countries in 1968, however, probably will amount to about 32 million tons annually.* Domestic

* New refineries at pipeline terminals plus the capacity of existing refineries.

production in 1968, assuming that the goals for 1965 are maintained, coupled with pipeline deliveries of up to 23 million tons, will amount to 26.4 million tons, or almost 83 percent of refinery capacity.

E. European Satellite Transportation System as a Whole

The pipeline will reduce the demands on the over-all transportation systems of each of the four Satellites for the transportation of crude oil in 1965. Nevertheless, the large increase in imports of crude oil, coupled with increased domestic production, will generate an increase in demands on the transportation system for the movement of refined products. It is not feasible to estimate the demands that may be levied on each mode of transportation, but it is reasonable to conclude that a railroad haul will be required for a major portion of the tonnage. It is not possible, either, to assess accurately the requirements for freight cars, locomotives, personnel, and route space, because the length of haul will be reduced and the distribution pattern will change. Moreover, the type of freight cars utilized most advantageously for the movement of refined products varies, to some degree, from the type required for crude oil. It is even possible that the amount of coal used by railroads will be reduced as petroleum is substituted for coal as a fuel for transportation, and this substitution itself would entail a reduction in tonnage to be carried because the calorific value of petroleum is much higher than that of coal. This situation has prevailed in a number of Western European countries since 1958, when coal tonnage has dropped as petroleum tonnage increased.

The increase in demand for the transportation of petroleum alone in 1965 amounts to about 44 percent above the demand in 1960, measured in terms of tons carried. The change will vary in each country. A detailed analysis of demand is shown in Table 7.*

IV. Comparative Freight Rates for Transportation of Crude Oil, by Mode of Transportation

A. Pipeline

A comparison of rates for transportation of crude oil by pipeline with the rates and charges by any other mode of transportation indicates a differential of between 75 and 80 percent.

In the Soviet Bloc the ministries controlling the petroleum industry operate the petroleum pipeline system as a private carrier and not as a common carrier offering service to shippers generally. For this reason, no rates, as opposed to costs, have ever been announced, and no

* Table 7 follows on p. 17.

Table 7

Comparison of Demand for Transportation of Crude Oil and Petroleum Products
in Poland, East Germany, Czechoslovakia, and Hungary
1960 and 1965

Million Metric Tons

Country	(1) Crude Oil: Domestic Production	(2) Crude Oil: Imports	(3) Refined Products: Domestic Production a/	(4) Refined Products: Imports	(5) Total Demand for Transportation	(6) Amount Transported by Pipeline	(7) Amount Transported by Other Modes of Transportation
				1960			
Czechoslovakia	0.137	2.300	2.193	0.400	5.030	0	5.030
East Germany	0.002	2.000	1.802	0.380	4.184	0	4.184
Hungary	1.215	1.500	2.444	0.070	5.229	0	5.229
Poland	0.194	0.713	0.816	1.800	3.523	0	3.523
Total	1.548	6.513	7.255	2.650	17.966	0	17.966
				1965			
Czechoslovakia	0.210	6.000	5.589	0	11.799	6.000	5.799
East Germany	1.000	5.000	5.400	0	11.400	4.000	7.400
Hungary	2.200	3.000	4.680	0	9.880	3.000	6.880
Poland	0.200	3.100	2.970	1.450	7.720	2.000	5.720
Total	3.610	17.100	18.639	1.450 b/	40.799	15.000	25.799
				1965 Compared with 1960 (Percent of Change)			
	+133	+163	+157	-45	+127		+44

a. Ninety percent of columns 1 and 2.
b. To be imported from Rumania.

rates are believed to exist. Therefore, the only measure of price paid for transportation of crude oil by pipeline is the cost. The USSR has announced that the cost of transporting crude oil through the pipeline now under construction to the Satellites will be between 0.90 and 1.0 kopek per ton-kilometer (0.25 cents).*

B. Railroad

The freight rate on crude oil transported by railroad varies with the length of haul. On the basis of current freight tariffs in the Soviet Bloc and the lengths of haul for which crude oil would be transported in the USSR and in each of the Satellites, railroad rates per ton-kilometer and per ton are computed as follows:

	Distance (Kilometers)				
Rate	350	400	450	700	2,088
Kopeks per ton-kilometer	4.93	4.69	4.60	4.00	3.88
Rubles per ton	17.26	18.76	20.70	28.00	81.00

An additional charge of 4 rubles per ton is levied for transloading crude oil at the Soviet border from Soviet wide-gauge cars to European standard-gauge cars.

C. Inland Water

Although adequate, direct inland waterway connections between Kuybyshev and the Satellites are nonexistent, crude oil could be transported from Kuybyshev by rail to the nearest Danube River port at Galati, Rumania, for onward transportation by river barge to Hungary and Czechoslovakia. The distance is so great, however, that a combination of rail and inland water rates exceeds the through rail rate.**

D. Sea

The current freight rate on crude oil moving by sea from Odessa to East German or Polish ports on the Baltic is about $2.50 (10 rubles) per ton, and to this rate an additional rate must be added for inland

* Pipeline revenue in the US in 1959 was at the rate of 0.31 cent per short ton-mile, or 0.21 cent per metric ton-kilometer.
** See Table 8, p. 20, below.

transport from Kuybyshev to seaport and from seaport to destination. This combination of rail-sea-rail rates is so prohibitive that when the pipeline system is in operation, exports of Kuybyshev crude oil from Black Sea ports probably will be discontinued. Such an export movement probably will not take place until construction of a pipeline from Kuybyshev to a Black Sea port is accomplished.

E. All Modes of Transportation

A comparison of rates and charges by all modes of transportation is outlined in Table 8.* An examination of the table reveals that transportation of crude oil by pipeline from Kuybyshev to the Satellites will result in Bloc-wide savings in transportation expenditures of 75 to 80 percent compared with any other mode of transportation. The economies within the Satellites alone are of such magnitude that the Satellites will be able to recover their investment in a remarkably short period of time.

The rate at which the USSR will be able to recover its investment in pipeline construction is not clear. The country normally sells crude oil to the Satellites at prices quoted f.o.b. the Soviet border and absorbs a substantial share of the transportation costs of this movement. Expenditures for pipeline transport from Kuybyshev to the Satellite borders will be from $15 to $20 cheaper per ton than rail transport. These substantial savings in transportation costs resulting from the use of pipeline transport could be passed along to the Satellites in the form of lower prices for Soviet crude oil. It is more likely, however, that the USSR will retain most if not all of these savings in order to accelerate the rate at which the substantial Soviet investment in the pipeline system will be recovered.

V. Economic and Military Strategic Significance of the Pipeline

There is no evidence that the Satellite portion of the pipeline system is intended for any purpose other than the supply of crude oil to the Satellites. The capacity of the line, however, will amount to about 23 million tons when all pumping facilities are installed. This figure is 8 million tons higher than the planned imports of crude oil by pipeline by the Satellites in 1965. It is entirely possible that full capacity could be achieved on completion of the pipeline in 1963, thus providing a capability to use the pipeline for transportation of a part of the crude oil shipped to Western European countries. By 1968, however, this excess capacity will be reduced or even eliminated, as new refineries at pipeline terminals in the Satellites will require 22 million tons, assuming that refinery construction goals are met.**

* Table 8 follows on p. 20.

** Text continued on p. 22.

Table 8

Comparison of Rates for Transporting Crude Oil from Kuybyshev, USSR, to Refineries in Poland, East Germany, Czechoslovakia, and Hungary by Mode of Transportation

Mode of Transportation	From	To	Distance (Kilometers)	Rate per Ton-Kilometer (Kopeks)	Rate per Metric Ton		Differential, Pipeline and Other Modes of Transportation (US $ per Ton)
					Rubles	Dollar Equivalent a/	
Railroad	Kuybyshev	Brest	2,088	3.88	81.01	20.25	
Pipeline			1,825	1.00	18.25	4.56	15.69
Railroad	Kuybyshev	Uzhgorod	2,500	3.88	97.00	24.25	
Pipeline			2,075	1.00	20.75	5.19	19.06
Railroad	Brest	Plock	400	4.69	18.76	4.69	
Transloading					4.00	1.00	
Total					22.76	5.69	
Pipeline			280	1.00	2.80	0.70	4.99
Railroad	Brest	Schwedt	700	4.00	28.00	7.00	
Transloading					4.00	1.00	
Total					32.00	8.00	
Pipeline			670	1.00	6.70	1.68	6.32
Railroad	Uzhgorod	Bratislava	450	4.60	20.70	5.18	
Transloading					4.00	1.00	
Total					24.70	6.18	
Pipeline			400	1.00	4.00	1.00	5.18

a. Old (before the 1961 currency reform) rubles may be converted to US dollars at the rate of 4 rubles to US $1.

Table 8

Comparison of Rates for Transporting Crude Oil from Kuybyshev, USSR, to Refineries in Poland, East Germany, Czechoslovakia, and Hungary by Mode of Transportation
(Continued)

Mode of Transportation	From	To	Distance (Kilometers)	Rate per Ton-Kilometer (Kopeks)	Rate per Metric Ton		Differential, Pipeline and Other Modes of Transportation (US $ per Ton)
					Rubles	Dollar Equivalent	
Railroad	Uzhgorod	Szazhalombatta	350	4.93	17.26	4.32	
Transloading					4.00	1.00	
Total					21.26	5.32	
Pipeline			380	1.00	3.80	0.95	4.37
Combined rail-and-water transportation							
Railroad	Kuybyshev	Odessa	2,000	3.88	77.60	19.40	
Sea	Odessa	Gdynia	7,300		10.00	2.50	
Railroad	Gdynia	Plock	270	5.56	15.01	3.75	
Total					102.61	25.65	
Pipeline	Kuybyshev	Plock	2,105	1.00	21.05	5.26	20.39
Railroad	Kuybyshev	Galati	2,480	3.88	96.22	24.06	
Inland waterway	Galati	Bratislava	1,000	3.22	32.20	8.05	
Total			3,480		128.42	32.11	
Pipeline	Kuybyshev	Bratislava	2,475	1.00	24.75	6.19	25.92

It is doubtful that the use of this pipeline system for military purposes was a major consideration in deciding to undertake the project. The system was designed exclusively for the transportation of crude oil, and the movement of crude oil cannot be alternated readily with the movement of light petroleum products such as gasoline or diesel fuel. Moreover, to alter the system to carry petroleum products instead of crude oil after the system is in use would require a time-consuming cleansing effort to avoid adulteration and an increase in storage facilities. Pumping equipment also probably would have to be changed, as the pumps used for a crude oil pipeline are not suitable for light products. The pipeline system, however, will contribute to an increase in the supply of fuels in Eastern Europe by making crude oil available at a minimum expenditure for transportation. Moreover, the pipeline system will relieve the intensively used railroad systems of the long haul of crude oil and petroleum products from the USSR, thereby improving their capability to carry other economic and strategic materials.

APPENDIX A

METHODOLOGY

1. Estimating the Cost of Pipeline Construction

The methodology employed in estimating the cost of pipeline construction is given in some detail in the text. The estimates of the cost in the US are based on reports in various engineering publications that indicate an average of $100,000 per mile. Estimates of the cost of construction in the USSR and the Satellites are based on the cost prevailing in the USSR in 1956 for pipelines of 15-inch, 20-inch, and 24-inch diameters. Although the cost of pipe has increased since 1956, the actual cost of construction has decreased with the advent of mechanized trenching equipment, improved pipe welding and wrapping devices, and improved technology gained through experience. Moreover, in a report to the Inland Transport Committee of the Economic Commission for Europe of the UN, 1 December 1961, the USSR announced the allocation of 355 million new rubles for the construction of 4,730 km of pipeline, including the crude oil pipeline to the Satellites. This amount reflects an average of about 750,000 rubles per kilometer, or about $100,000 per kilometer.* The cost of constructing terminal and intermediate storage tanks is not included in these estimates, because storage tanks would be required regardless of the mode of transportation used to transport crude oil.

2. Estimating Expenditures for Transportation of Petroleum

Expenditures for rail transport are based on current freight rates applicable in the USSR and published in Spravochnik po tarifam zheleznodorozhnogo transporta (Handbook of Railroad Freight Rates), Moscow, 1955. Expenditures for sea transport are based on current freight rates between the Black Sea and Polish Baltic seaports published in various shipping publications, including the Weekly published by the Maritime Research Inc., New York, N.Y. Current costs, as opposed to rates, for the transportation of crude oil in tank cars in the four Satellites are not available. The average cost for all commodities in 1958 in the USSR, however, was 2.93 kopeks per ton-kilometer. The cost of transporting crude oil in tank cars is considerably higher than the average, for empty car movement is normally 100 percent of the loaded haul. It is believed, therefore, that the actual rail cost for transportation of petroleum in railroad cars is between 3.5 and 4 kopeks per ton-kilometer and is very close to the rail rate.

* Data as given in the source are in new rubles and were converted to old rubles at the rate of 10 old rubles to 1 new ruble.

3. Estimating Tank Car Requirements

For the purposes of this report, minimum tank car requirements are estimated on the basis of the following factors to determine turnaround time and annual carrying capacity: (a) the length of haul is multiplied by two because tank cars are loaded in one direction only; (b) the average daily movement of a tank car is estimated to be 300 km; (c) the time required for loading, unloading, switching, and billing is estimated to be 1.75 days; and (d) the average load per car is estimated to be 40 tons (USSR) and 30 tons (European Satellites).

Example 1: USSR

Kuybyshev to Brest and return: 4,176 km divided by 300 km	13.92 days
Plus loading, unloading, and switching time	1.75 days
Turnaround time	15.67 days
365 days divided by 15.67 days yields the number of times each car is used per year	23.29 times
Multiplied by tons per trip	40 tons
Tons per car per year	931.60 tons

Therefore, the total annual tonnage divided by 931.60 would equal the number of tank cars required. This number would represent the operating park, or 90 percent of the total, as it is estimated that 10 percent of the tank car inventory is undergoing maintenance and repair at all times.

Example 2: Satellites

The same methodology used in Example 1 is used in Example 2, at 30 tons per loaded car and according to the round-trip distances indicated:

	Kilometers
a. Brest to Plock and return	800
b. Brest to Schwedt and return	1,400
c. Uzhgorod to Bratislava and return	900
d. Uzhgorod to Szazhalombatta and return	700

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