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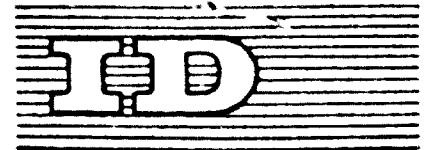
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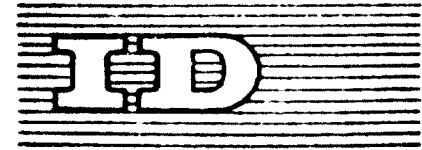
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THE STATE AND DEVELOPMENT OF THE USSR
AUTOMOTIVE INDUSTRY; ITS ROLE AND
SIGNIFICANCE IN THE NATIONAL ECONOMY^{1/}

by

V. Fobedonostsev
Deputy Chairman
Scientific and Technical Council
Union of Soviet Socialist Republics

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SUMMARY

1. The development of the automotive industry in the Union of Soviet Socialist Republics has been planned according to principles of socialist economic planning. The Union of Soviet Socialist Republics' automotive industry therefore is characterized by specialization, concentration and co-operation. Each of the relatively few but large factories produces only one specific model and its derivatives. Some factories produce a large number of parts to be incorporated in the vehicle; others obtain parts or units from specialized components manufacturers, or from other automotive plants. This leads to high volume and effective production.

* This is a summary of a paper issued under the same title as ID/WG.13/9.

^{1/} The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO.

2. The paper enumerates the automotive factories of the country and gives basic data on the specific models produced in these plants. Up to the present time, the production of different types of lorries, tractors and buses prevailed so as to meet the requirements of the national economy. During the coming years, emphasis will be placed also on the production of passenger cars.
3. In 1965 approximately 616,000 vehicles were produced, including approximately 200,000 passenger cars and 27,000 buses.
4. The automotive industry occupies a leading place in the national economy. It influences the development of almost all branches of industry and provides the means of transportation which are of greatest importance to the country.
5. The national economy plan provides for the distribution of transportation means and services. General road transport enterprises are supervised by the road transport ministries of the Union Republics which run maintenance and repair facilities, refuelling stations, etc. A central scientific research institute studies the most effective ways to utilize the vehicle park.
6. The paper also deals with the research carried out to reduce the costs of maintenance and repair of the vehicle park. Recommendations are made in the fields of maintenance and repair schedules, road construction, choice of materials, design, etc.
7. The influence of the automotive industry on road construction and allied machinery industry is recorded briefly.

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I. A BRIEF SURVEY OF THE DEVELOPMENT OF THE USSR AUTOMOTIVE INDUSTRY

The period up to 1928

1. In the history of world automobile manufacturing, the late nineteenth and the first decade of the twentieth centuries witnessed the establishment of the automobile industry in Western Europe and in the United States of America. Czarist Russia was industrially too weak to set up an automobile industry. The demand for automobiles (consisting mainly of passenger cars at the time) was met by foreign imports.
2. Russian inventors and designers, however, were already thinking of producing a Russian car. They had conceived the idea of a "horseless carriage" as early as the eighteenth and nineteenth centuries, but all projects remained buried in the depths of departmental files. The first petrol-run car was designed and constructed by E.A. Yakovlev at his internal-combustion engine plant. The car was demonstrated at the Nizhni Novgorod Exhibition in 1896. In 1899, an attempt was made by the Leitner Firm in Riga, to organize sales of the car which was partly made of foreign parts, but it soon proved unsuccessful.
3. The first Russian lorries were designed by V.G. Iutska, a well-known internal-combustion engine designer and began to be assembled in 1901 at the Lessner Plant in St. Petersburg. In 1902, the Lessner lorry successfully competed with foreign firms in tests made at Kursk and Kiev. For six years, Lessner strove hard to organize mass car production, but in the seventh year, unable to face foreign competition, he changed over to car repairing.
4. The Russo-Baltic plant in Riga started automobile manufacturing in 1908. In 1910, with the technical aid of a Belgian firm, the factory produced the design of its first ten cars, but it, too, was unable to withstand foreign competition and closed in 1916, after having produced a total of 451 cars.
5. The defeats sustained during the First World War, which were partly due to the shortage of vehicles, forced the Czarist government to try to build automobile factories in many Russian towns, including Moscow. On 20 February 1916, a general agreement was concluded between the Central Military and Technical Authority and the trading company "Kuznetsov, Ryabushinski and Co." for the production and delivery of 1,500 automobiles. The Ryabushinskis were bound under the agreement to construct and equip the factory no later than

7 October 1916, and to produce the first 150 automobiles by 7 March 1917. Thus began, in the Tufelevi Wood south of Moscow, the construction of the AMO automobile factory (the Moscow Automobile Company), now known all over the world as the I.A. Likhachev factory. The industrialists, however, failed to observe the agreement and the factory was not built in the stipulated time.

6. Soviet Russia inherited repair specialists from the capitalists instead of an automobile factory. At the time, there were about 40,000 cars in the country, most of which needed repair. The AMO Factory naturally had to repair and reconstruct old cars.

7. By 17 November 1924, however, 10 AMO F-15 Soviet-made lorries took part in the parade organized in Red Square on the occasion of the seventh anniversary of the October Revolution. That day is considered the birthday of the Soviet automobile industry. The first Russian automobiles were the AMO F-15 one and a half ton lorries with 4 cylinder 4.4 litre petrol engines.

8. An attempt made by the Czarist industrialist Lebedyev in 1916 to build motor works in Yaroslav and Moscow, with the help of government grants, also met with failure. Instead of the factory, three small buildings were built in which car repair work was undertaken after the War. It was here that, in 1925, production of the YA-3 3-ton lorry with the AMO F-15 engine was begun on a small scale.

9. The first Soviet small engine four-seater KAMI-1 cars designed by the Scientific Motor Engine Institute were produced at the Moscow 'Spartak' car repair factory in 1927. The AMO F-15, the YA-3 and the KAMI-1 were thus the first Soviet cars and lorries. The production of these vehicles in the early days of the automobile industry, was on a small scale, simple tools and a large amount of manual labour were used.

The period from 1928 to 1940

10. During the first five years of this period (1928-1932) new motor works were erected and mass production was organized in accordance with the most advanced technology of the time. The AMO factory was rebuilt for the first time in order to enable it to reach an annual output of 25,000 ZIS-5 lorries, which replaced the AMO F-15.

11. The AMO F-15 lorry was extremely tough and reliable. However, due to the fact that its essential parts were difficult to mass produce, and owing

to the country's need for heavier vehicles, factory collectives began work on new lorry designs. The AMO F-15 was replaced by the AMO-2, then by the AMO-3, and finally by the 6-wheeled ZIS-5, which for many years was one of the main means of transport in the country's national economy and in the army. The ZIS-5 was a 3-ton lorry with a 73 h.p., 4 cylinder 5.5 litre engine. Several modified designs were later produced with the use of ZIS-5 components (such as the 6-wheeler ZIS-6 lorry and the 34 seater ZIS-16 bus). In 1936 and 1937 the factory began the production of the de-luxe 6 seater ZIS-101 limousine, with an 8 cylinder 40 h.p. engine.

12. American experts, mainly from the Ford Motor Company, helped to establish the first Soviet motor works (the Moscow and the Gorki) and taught Soviet engineers and craftsmen the intricacies of automobile production. As a result of further developments in automobile design, the Yaroslav Factory produced the YA-5 5-ton lorry, which was replaced in 1936 by the YAG-6, a 73 h.p. lorry, built at the Moscow Motor Works and produced until 1941. The factory also produced tip-up cabs, 6 cylinder 8-ton lorries, 8 wheel drive lorries and other vehicles. They concentrated on developing the design and organizing the production of the YATP-1 50 seat trolley-bus, which was produced in 1941.

13. During this period of 1928-1932 the Gorki Motor Works was also established. The first GAZ-AA 1.5-ton lorry came off the main conveyor belt on 25 January 1932. Production of the GAE-A convertible and of the 16 seater GAZ-03-30 bus with the body of the GAZ-AA began in 1933. The factory began to produce the new F-1 sedan cars instead of the GAZ-A in 1936. During 1937-1938, the GAZ-AA underwent extensive modernization. Its engine power was increased to 50 h.p.: essential parts were improved and a new steering mechanism, a new cylinder head and other new features were introduced. The factory also produced the GAZ-410 tip-up cab, a 6 wheeler lorry and a number of other modified vehicles based on the assembly of the GAZ-AA lorry. In order to satisfy the demand for cars in Moscow, yet another factory was built, which produced, from 1940 onwards, the 20 h.p. "KIM-10" 4 seater 2 door sedan.

14. The MAMI Scientific Research Institute played a valuable role in drawing new automobile designs and in training staff. A scientific automobile laboratory was set up in Moscow in 1918 under the Scientific-Technical Department of the Higher Council of the National Economy. It formed the basis for the development of automobile research work in the USSR. The automobile laboratory

was expanded and reorganized in 1920, and became the Scientific Automobile Institute (Nauchnyj Avtomobilnyj Institut - NAMI). Subsequently, in 1936 and 1942 the aero-dynamics and tractor construction departments were moved out of that Institute because independent scientific establishments, and the remaining departments were organized into the Scientific Research Automobile and Engine Construction Institute (NAMI). Its work is still closely related to the automobile industry.

15. The establishment of the automobile industry played a most important part in the rise and development of new and essentially allied branches of industry, such as bearings, electrical appliances, tyres and rubber industries. It also played a leading role in the organized production of high quality types of steel and pig-iron, and new metals.

The period from 1941 to 1955

16. Although the Second World War of 1941-1945 put a temporary stop to automobile production, it also encouraged the development of the automobile industry. By removing some of its equipment to the towns of Ulyanovsk, Niass and Shadrinsk, the Moscow Motor Works laid the foundations for new automobile plants. By 1944, the Niass Works had become a vast plant with its own processing and mechanical shops for assembling the ZIS-5 lorry. Another plant, which later undertook the production of the GAZ-AA lorry made by the Gorki Automobile Plant, was built soon after 1944 in Ulyanovsk. The production of the automobile units was organized in Shadrinsk.

17. During the post-war period, an intensive effort was made to rebuild the shattered national economy, and a new effort was made by the Soviet people to boost the development of industry and agriculture. The automobile industry made great progress during this period. New factories were built: the large-tonnage lorry plant in Minsk in the Byelorussian SSR, the new medium-tonnage lorry plant in Kutais in the Georgian SSR, and the car assembly plant in Odessa. The Likhachev and Gorki motor works were reconstructed and expanded, and a small-car motor works was established in Moscow on the site of the "KIM" Plant. New bus factories were built in Lvov in the Ukrainian SSR, and in Pavlov in the Gorki Region. Specialized factories were set up in various Soviet towns to produce tip-up cabs, petrol tankers, vans, trailers, and semi-trailers.

18. Thus, the expanded manufacturing made it possible to increase automobile production from 145,400 in 1940 to 102,300 in 1946, and 445,000 in 1955. Therefore, car production had increased three times in this fifteen year period. During the post-war period intensive efforts were also made to elaborate and develop new automobile designs. Almost all factories started to produce new automobile models.
19. Gorki Motor Works began producing such new automobiles as the GAZ-51 2.5 ton lorry, which had a 4 stroke, 6 cylinder 70 h.p. engine with a working capacity of 3.48 litres and a compression ratio of 6.2; the heavy-duty 2-ton GAZ-63 lorry, the 5 seat "Pobeda" saloon, and also the improved GAZ-69 (4 x 4) convertible. The Ul'yanovsk Motor Works took over the production of GAZ-AA lorries.
20. The Moscow I.A. Likhachev Motor Works organized the production of the following automobiles: the ZIL-150 lorry, later replaced by the 4-ton ZIL-164, the heavy-duty ZIL-151 (6 x 6) lorry with a tonnage of 2.5 - 4.0, the high-class ZIL-110 cars with 8 cylinder 110 h.p. engines and the ZIL-158 city buses. The Ural Car Factory in Niass was charged with the production of the ZIS-5.
21. The Yaroslavl Motor Works began to produce 2 stroke 6-8 cylinder 110-165 h.p. diesels and also the heavy 6 wheeler YAZ-210 12-ton lorries and the YAZ-210E 10-ton diesel tip-up lorries with the YAZ-206 165 h.p. engine.
22. The Minsk Motor Works first produced the 4 wheeler MAZ-200 7-ton lorry and the MAZ-205 5-ton lorry with the YAZ-204 110 h.p. diesel engine made by the Yaroslavl Motor Works. The Minsk Motor Works also designed and produced a 25-ton quarry truck which was widely used in the construction of hydro-electric power stations and in open-pit mining.
23. New models were added to the range of Soviet-made passenger cars and buses, such as the "Moskvich 401" produced by the Moscow small-car Motor Works, a 4 seater saloon with a 4 cylinder 26 h.p. engine of 1.07 litre capacity, the 5 seater middle-class "Pobeda" made by the Gorki Motor Works, de-luxe cars made by the ZIL Gorki Motor Works, and the ZIL-110 produced by the Moscow Likhachev Factory. The construction of buses for local and inter-city travel was organized at the Pavlovsk and Lvov Bus Factories.

24. The main lorry modifications were the following: tip-up cabs manufactured by the Odessa Automobile assembly plant based on the GAZ-51 lorry also assembled by the plant, a tip-up lorry based on the ZIL-150 lorry and the ZIL and GAZ road tractors designed for use with trailers and semi-trailers.

The period from 1951 to 1959

25. The rapid development of the national economy and the resulting increase in transport operations created a need for a corresponding increase in automobile production. The automotive industry, which is, in the Soviet Union, the only organization which supplies transport vehicles, was therefore called upon to take steps to increase the production of lorries and to improve their efficiency. One of the most important of these measures was the reconstruction of certain automobile plants and the establishment of new manufacturers.

26. The following plants were built during this period: the Kremenchug plant at Kremenchug in the Ukrainian SSP, the Byelorussian plant at Yhodino, the automobile assembly plant at Frunz in the Kirghiz SSR, the motor works at Zavolzhsk in the Gorki region, various plants for producing trailers, semi-trailers and units, and factories for producing spare parts.

27. Among the measures taken to improve productivity must be mentioned the new and more advanced designs for automobiles with a higher tonnage and speeds of approximately 70-80 km/h; the construction of improved lorries for agricultural use, autotrans consisting of a tractor using trailers and semi-trailers; and specialized equipment for transporting specific types of material.

28. Accordingly, the I.A. Likhachev Moscow Motor Works replaced its 4-ton ZIL-164 lorry by the 5.5 ton ZIL-130 with an 8 cylinder V-shaped 150 h.p. engine, and the 6 wheel-drive ZIL-157 3 lorry by the more advanced ZIL-157. The Gorki Motor Works began to produce the GAZ-53 4-ton lorry as well as the GAZ-52, and replaced the GAZ-63 with the 2-ton (4 x 4) type GAZ-66 lorry. Many modifications were based on the GAZ-53 and ZIL-130 open lorries, such as tip-up cabs, tractors, articulated lorries, refrigerated lorries, etc.

29. The Yaroslavl Motor Works underwent extensive reconstruction. It gradually reduced the production of the 2 stroke diesel YAZ-204 and YAZ-206, and specialized in the production of the 4 stroke, 6, 8, and 12 cylinder, V-shaped, 180-320 h.p. engine YAZ-136, YAZ-238, and YAZ-240 lorries. The

- production of automobiles made by the Yaroslav Plant was entrusted to the newly built Kremenchug plant in the Ukrainian SSR which organized the production of cars of the same size under the trade mark "KRAZ".
30. After reconstruction, the Minsk Motor Works began to produce new 4 wheel MAZ-500 7 $\frac{1}{2}$ -ton lorries using a YAMZ-236 engine; the MAZ-503 7-ton lorry and MAZ-504 tractor designed for use with a 17 $\frac{1}{2}$ -ton trailer. The Kutais Motor Works produced the KAZ-606 tractor with a 7-6-ton semi-trailer.
31. The Ural Motor Works also underwent extensive reconstruction. After it had begun to produce the ZIS-5 and UTM-355 cars based on the ZIS-5, it shifted to the production of the heavy duty (6 x 6) 5-ton URAL-375 and the 8-ton URAL-377 (6 x 4) lorries with a ZM-180 h.p. engine designed for agricultural transport in difficult conditions.
32. The newly built Byelorussian Motor Works took over the production of the MAZ-525 tip-up cabs from the Minsk Motor Works, increased the tonnage of the cabs from 25 to 27 tons and marketed them as the BELAR-500. The Uljanovsk Motor Works took the GAZ-AA automobiles out of production and changed over to 4 x 4 and 4 x 2 type 0.8-1-ton lorries with truck, van and bus modifications.
33. The construction of new facilities and the rebuilding and expansion of existing ones considerably increased the production potential of the car and bus plants. Among these was the new small engine car factory in Zaporozhe in the Ukrainian SSR, which had a system of shops for producing chassis and body work components. A new air-cool engine plant was built for the Zaporozhe Motor Works in Melitopol, also in the Ukrainian SSR. The Zaporozhe factory, which began production in 1963, produced 40,590 ZAZ-965A cars in 1965. The re-equipped and expanded Moscow small engine motor works, in 1965 produced 76,825 Moskvich cars.
34. A new factory was built in Likino in the Moscow region for the production of the medium sized LIAZ-158 buses. The factory had shops for chassis production, and also a mechanical shop for producing certain body work components. In 1965, it produced 6,200 LIAZ-158 buses. The Lvov bus factory underwent extensive reconstruction. Its output considerably increased when the automobile cranes and bread vans, which had been temporarily made there, were taken out of production.
35. As a result, the production of passenger cars and buses considerably increased during the period 1955-1965, as shown in the following table:

Table 1

Number of automobiles produced
1950-1965

	<u>Passenger Cars</u>	<u>Buses</u>
1950	64,514	3,939
1955	107,806	9,415
1960	138,800	18,400
1965	201,175	26,840

II. THE BASIC PRINCIPLES OF SOCIALIST ECONOMIC PLANNING

36. The establishment of social property of capital goods and means of production is one of the political and economic prerequisites of a planned economy and of planning, in general. The nationalization of industry, transport, the land, banks, and foreign trade formed one basis for the planned economy of the USSR.

37. The economic policy of the Communist Party and the Socialist State, which is based on an understanding and application of the objective economic laws of socialism in concrete historical conditions, found its practical expression in economic plans. Planning is based on the economic rules of socialism: viz. the basic economic law of socialism, the law of the planned proportional development of the national economy, the law of priority development of means of production, the law of distribution according to work done, the law of steady growth of productivity and the law of establishing costs. One of the fundamental principles of planning is that of the basic link, which allows essential resources to be used primarily for the development of heavy industry, in order that the tasks of the national economic plan may be promptly implemented.

38. Uniformity of and co-ordination between all tasks, as well as between the State plan and the ministerial, republican, local and company plans, is essential for both elaboration and the implementation of the economic plan. The interdependence of all the sections and indices of a national economic plan reflect the real proportions and links of the process expanded socialist reproduction.

39. The national economic plan can be divided into sectors, which cover the various aspects of expanded socialist reproduction: the production programme,

the transport plan, the plan for the development and the introduction of new technology, the capital labour plan, the plan for labour and wage supplies to the national economy, the socio-cultural construction plan, the trade turnover and production plan, the cost plan, the plan for the development of the national economy at a union-republic and economic region level and a summary analysis of the national economic plan for the coming period.

40. The index system of the national economic plan includes natural indices (tasks for producing priority industrial products, freight transportation, etc.) and cost indices (gross industrial production, investments, trade turnover, wage funds, etc.). Together, these two kinds of indices reflect the material and cost proportion of social production. The planning of quality indices (productivity, techno-economic costing, profitability, etc.) indicates the tasks for improving the use of fixed assets, assets in turnover and manpower. The planning of finance (the State Budget, credit and cash plans) and prices are constituent parts of national economic planning.

41. Targets for production, capital labour, labour and other branches of the national economic plan are established for industry. The general production plan includes indices for gross and commodity production, for product assortment and quality, technical-economic indices, and the co-operative delivery plan. Industrial planning based on the state self-costing method is carried out directly according to State plans which cover all the aspects of expanded socialist reproduction.

42. The over-all co-ordination of all tasks within the national economic plan in accordance with the requirements of the law of planned proportional development is ensured by the system of balances in planning. At present the system of balances used in national economic planning includes:

- (a) Material balances (industrial and agricultural production balances, industrial production capacity balances, balances of rolling stock in transport, energy resources balances, etc.);
- (b) Financial balances (balances of the income and expenditure of economic organizations, and the income and expenditure of the population);
- (c) Manpower and staff balances.

The system of balances makes it possible to establish in advance the requirements of the economy and population, as well as the amount of material, financial, and labour resources; and the co-ordination required between them.

43. By means of the balance method, the correct proportion between the various branches and spheres of activity of production can be determined in relation to the economic and political tasks and the main links of the national economic plan. The balance task of the USSR national economy is resolved by the coordination of the material, financial and labour balances in planning.

44. Centralized management of the national economy according to basic indices is combined with independence and initiative on the part of local authorities, industrial and transport enterprises, collective farms (kolkhozes) and state farms (sovkhozes). The planning bodies are an integral part of Soviet state machinery. The establishment of national economic plans and of a single state budget, as well as the necessary measures for implementation, are entrusted to the higher bodies of state government authority. The State Planning Committee of the Council of Ministers of the USSR plays a direct role in national economic planning.

45. The most important task of the USSR state planning bodies is to establish the correct correlations between the various sectors of the national economy in the draft plan, as well as to indicate any necessary disproportionate measures. The union-republic state planning bodies are responsible for planning the national economy at the republican and local levels. They work out draft plans for the economic development of the republic, including sectors of union-republic or republic industry, and also submit suggestions for draft production plans relating to public enterprises situated in the republics. Correct territorial planning, and the comprehensive utilization of natural, human energy and other resources is thus ensured.

46. The local planning authority represented on the Council of Workers' Deputies carries out plans for work in areas (oblasti), regions (krai) and autonomous republics. In the ministries, departments and boards, there are bodies or departments (economic planning and production planning) which devise plans for the development of corresponding sectors and enterprises, and supervise their implementation. The Government statistical bodies are directly linked to the whole planning system. The USSR Council of Ministers' Central Statistics Board (CSB) is the principal authority for the centralized management of statistical calculations.

47. The organization and implementation of the national economic plan falls into the following main stages: assessment of a plan's fulfillment during the preceding period; acceptance of the economic-political directives for the national economic plan by the Party and the Government; the elaboration of draft plans by ministries, departments and union republics; the establishment of targets for material, financial and human resources; the development of the draft state plan by the USSR state planning body in conjunction with the ministries, departments and republican authorities; the examination and confirmation of the draft state plan by the Government; the transmission of the approved tasks to ministries, departments, republican authorities and enterprises. The planning of the national economy goes beyond the elaboration of each stage and includes checking its fulfillment and amelioration in the course of implementation.

III. THE CHARACTERISTICS OF THE AUTOMOTIVE INDUSTRY AND FUTURE PROSPECTS

48. Specialization and concentration of production in large enterprises, such as the Moscow I.A. Likhachev Factory, the Ural Motor Works, etc., is a peculiar characteristic of the USSR automobile industry. Production at these factories is concentrated on one automobile model and its basic modifications, such as tip-up cabs, articulated lorries and 6 wheeled lorries. This production system is due to the socialist nature of the Soviet economy. The development of the USSR automobile industry is planned by competent government organizations, who, guided by the economic law of socialism, will not permit the production of automobiles of the same tonnage and the same type at different factories. Accordingly, the Soviet automobile industry is highly specialized and concentrated in large enterprises.

49. Specialization and co-operation (i.e. the planned production link) is, and will continue to be, the basis for the development of the Soviet automobile industry. All the union motor works have been constructed on the principle of specialization. Some of them are of a comprehensive nature; i.e. they have a complex system of production workshops which carry out the processing and production of the finished automobile. Thus, for instance, the Moscow I.A. Likhachev Motor Works, which specializes in medium-tonnage automobiles and engines, has a complete system of shops; including shops for processing work and shops for producing specific units.

50. Certain other factories which specialize in automobile production obtain some of their units, components and parts from other factories through the co-operative system. For instance, the Minsk Motor Works, which specializes in the production of heavy vehicles, does not have a system of engine production workshops. It obtains engines from the Yaroslavl Motor Works through the co-operative system. The Lwow Motor Works - producers of medium-sized buses - generally makes its own chassis and obtains engines and body work components through the co-operative system. The Moscow factory as well, which specializes in the production of small engine cars, does not have a system of foundry workshops. Further specialization has led to the setting up of factories which produce specific units and parts (for example the Grodnensk car-dan shaft plant, the Michurinsk piston ring plant, etc.).

51. The automobile industry also has a highly developed network of specialized factories or subsidiary plants which supply the main motor works with standard items: head lamps, steering wheels, carburettors, oil and petrol equipment, lights, fixtures, electrical apparatuses, etc. Factories specializing in the technological aspects of the industry, such as foundries and smithies, have recently begun to supply goods to the main factories.

52. Specialization and concentration are the characteristic features of the automobile industry in the Soviet Union and form the basis for mass production, which in turn is essential for the efficient organization of production and for the maintenance of the production process at a high technical level. On the whole Soviet automobile technology is sufficiently highly developed to compete successfully with European and American firms in European, African and Asian markets.

53. Moulding in the foundry workshops of the motor works is done in modern moulding boxes. Transportation and spraying of the mould is done on an enclosed conveyer belt. The moulds are beaten on an automatic beating grid; hot pressing of parts is generally done on vertical moulding presses. Mechanical processing is carried out by means of multi-positional unit tools, which are situated along automatic production lines. The parts are cut from sheet steel in modern crank presses equipped with sheet packers and automatic arms. The car is painted on an electrostatic floor and dried in radiation furnaces. All this shows the high technological level of automobile production, characteristic of mass production plants.

54. Unfortunately, automobile production in the Soviet Union does not meet the demand: in 1965, 616,400 automobiles were produced. A further increase in car production is provided for in the directives given by the XXIII Congress of the CPSU plan for the development of the national economy for the period 1966-1970. According to these directives, car production should have reached 1,360,000 to 1,510,000 by 1970, i.e. 600,000-650,000 lorries and 700,000-800,000 cars; or 1.6 to 1.7 times as many lorries and 4 to 5 times as many cars. For this purpose existing plants will be expanded and new ones built.

55. During this five-year period, technologists work to improve the design, technical performance and quality of automobiles. The automobile industry today has an efficient production basis, a large number of highly qualified experts (engineers, craftsmen and workers), a highly developed network of design and technological-scientific research institutes, and is capable of solving the tasks placed before it by the country's national economic plan.

IV. THE RELATION OF THE AUTOMOBILE INDUSTRY TO OTHER BRANCHES OF INDUSTRY AND THE PART IT PLAYS IN THEIR DEVELOPMENT

56. Automobiles are not only the products of automobile manufacturers; many branches of industry supply the motor works with products. For instance, the ferrous and non-ferrous metallurgical industry supplies metal; the petrochemical branches of industry supply petrol, oil, paints and plastic goods; the rubber industry supplies tyres, washers and stuffing boxes; the electrical industry supplies wires; the radio industry supplies wireless equipment; the construction industry supplies glass; and the textile industry supplies stuffing and upholstery material. The automobile production system also includes industries which produce carburettors, petrol and oil pumps, crankshafts, batteries, starters, distributors, lights, electric light equipment, electrical fixtures, fuel, oil and water gauges, speedometers, etc.

57. The part played by all branches which supply raw materials and semi-manufactured and ready-made goods can easily be seen if one examines the estimated cost of the automobile. Thus, the ancillaries account for 65% or nearly two thirds of the cost of a medium-sized car, which means that they account for 650,000 rubles for a car produced at a cost of 1,000,000 rubles. This fact amply demonstrates the influence of the automobile industry on the development of allied branches of the industry.

V. THE PLACE OF THE AUTOMOBILE INDUSTRY IN THE NATIONAL ECONOMY OF THE USSR

58. The automobile industry occupies a leading place in the country's national economy. Its product influences the development of all branches of industry and agriculture, either as a means of transport or as a piece of technical equipment.

59. When used as a means of transporting goods, the automobile can successfully compete with such powerful means of transportation as the railway. This is borne out by the information given in the estimates of the CSB (Central Statistical Board - Centralnoye Statisticheskoye Upravleniye) regarding the fulfillment of the State plan for the development of the USSR national economy for 1965.

Table 2

Comparison of rail, river, road and pipeline transport, 1964 and 1965

	<u>1965</u>	<u>1965 as a percentage of 1964</u>
<u>Freight transportation in million tons</u>		
Rail Transport	2,401	106
General River Transport	269	107
General Automotive Transport	2,353	106
Transport by Pipeline	226	106
<u>Freight turnover in million t/km</u>		
Rail Transport	1,948	105
General River Transport	134	108
General Automotive Transport	42	109
Transport by Pipeline	147	131

60. The above table clearly shows that the amount of goods transported by road is comparable with that transported by rail and is easily in excess of that transported by river or pipeline. It should also be mentioned that the CSB data relate only to general automotive transport, i.e. that administered by the Ministry of Transport and Motorways of the Union Republics, and not to transport operations carried out by the transport departments of various enterprises, state farms (sovkhozes), collective farms (kolkhozes) and other organizations.

61. Increasing technological use is being made of the automobile today. For instance, it can be extremely useful in the construction of hydro-electric power stations and timber yards, as well as in harvesting, laying gas and pipe lines, drilling and excavation work and in public works such as street cleaning.
62. Many branches of industry which supply products to motor works take part in the process of automobile production, and their supplies account for approximately 65% of the cost of the automobile. This shows the important part the automotive industry plays in the development of these branches. The provision in the 1966 - 1970 Five-Year Plan for the production of 1.6 times as many lorries and 4 to 5 times as many passenger cars will require the development of not only the automobile industry but also of the branches of industry which supply it, viz. the ferrous and non-ferrous metallurgical industry, the petrochemical, textile and the tyre industries, etc.
63. The automobile is a convenient form of passenger transport and its use is developing with the rise in national prosperity, as confirmed by the growth of passenger travel by road.

Table 3

Growth of passenger travel by road, 1950-1964

	<u>1950</u>	<u>1960</u>	<u>1964</u>
Number of towns with a local bus system	459	1,241	1,539
Passenger transport (in millions)	1,001	10,634	15,982
Number of inter-city bus services	1,942	7,505	12,825
Total distance covered by inter-city bus services (in 000/km)	134.9	751.1	1,267.8
Passenger transport (in millions)	51.9	681.3	1,017.9

64. The automotive industry also influences the development of the machine tool industry. If more automobiles are produced, more factories capable of producing large quantities of high precision tools will be needed.
65. The above considerations clearly show, therefore, that the automobile industry occupies one of the leading places in the country's national economy.

VI. THE CHARACTERISTICS OF USSR AUTOMOTIVE TRANSPORT

66. The term "automotive transport" denotes the entire rolling stock, communication systems, warehouses and processing plants, maintenance services, refuelling and repairs. The rolling stock consists of lorries, cars, tractors, trailers and buses. The use of trailers with tractors or lorries (autotrains) increases load capacity and productivity and diminishes expenditures.

67. Road transport developed during Soviet rule. There was practically no automotive transport in Czarist Russia. Before the First World War, there were 8,800 automobiles in the country, mainly cars belonging to capitalists, merchants and high officials. During Soviet rule, a road transport system developed as a result of the establishment of an independent automotive industry, and it now includes many lorries, buses and trailers.

68. The development of Soviet road transport is based on the national economic plan, which provides for the distribution of all transport operations according to the types of transport needed. Road transport operations are carried out in areas without railways or waterways. Automobiles are also used for unloading freight and passengers and loading them aboard trains and boats, for urban and suburban communications, for major transport operations in towns and large industrial enterprises and for long distance transport operations.

69. The road transport economy is divided into general and specialized operations, according to the nature and purpose of the work. General road transport enterprises supervise transport operations regardless to which department they belong. They also organize public transport by bus and taxi. They, in turn, are supervised by the Road Transport Ministries of the Union Republics, which have automotive transport authorities in every region. The Automotive Transport Ministries of the Union Republics have large general motor and tyre repair factories, refuelling stations and service factories for repairs.

70. All scientific, technical and research work done to achieve the most effective utilization of the rolling stock is the responsibility of the Central Scientific Research Institute, which forms part of the road transport system of the RSFSR. The road transport departments are responsible for transport operations involving one or several enterprises.

71. A considerable number of cars are privately owned by Soviet citizens and workers, collective farm workers and members of the intelligentsia. Road transport is steadily increasing and its contribution to general transport operations is developing along with industrial and agricultural development. This is shown in the following table:

Table 4

Road transport development, 1953-1964

	<u>1953</u>	<u>1964</u>
Number of cars produced in the USSR	511,074	603,084
General road transport operations (in million tons)	18.4	38.7
Loads transported by general road transport (in million tons)	1.1	2.2
Passenger transport by bus (in millions)	3.3	17.0

72. The five-year national economic development plan provides for an increase in industrial production of between 47 and 50 per cent, and an increase in the turnover of freight and passenger road transport of 170 and 100 per cent respectively. Freight and passenger road transport is steadily increasing and new more advanced lorries, buses and cars are being used.

73. A general outline of the basic lorry types, cars and buses that carry out transport operations is given in Tables A, B and C respectively in the Appendix. It can be noted from this data that Soviet road transport has adequate resources to meet the requirements of the national economy with respect to freight and passenger transport operations.

VII. THE INFLUENCE OF AUTOMOBILE TRANSPORT ON THE NATURE AND STRUCTURE OF THE ROLLING STOCK

74. Automobile transport is an important sector of the national economy of the USSR and an integral part of the country's unified transport network with a freight turnover equal to that of rail transport. In accordance with the USSR National Economic Development Plan for 1966 - 1970, general road transport should increase its freight 1.6 times.

75. This must be carried out not only by increasing the number of automobiles, but by a rational standardization of the automobiles' components and of its structure, i.e. in quantitative ratios between different types of automobiles. The standardization of the automobiles produced by various enterprises is the result of joint work by industry and road transport, which will eventually establish a standardized range of cars consistent with the transport requirements of the national economy.

76. There are basic requirements for establishing a standardized range of automobiles. As mentioned earlier, two types of lorries were produced in the early days of Soviet automobile design - the 3-ton ZIS-5 and the 1 $\frac{1}{2}$ -ton GAZ-AA. Later, as industry and agriculture developed and production increased, there was a greater demand for freight transport. Road transport therefore needed larger tonnage lorries, and the 3-ton ZIS-5 lorry was replaced by the 4-ton ZIL-150 and ZIL-164 lorries, and finally by the modern 5 $\frac{1}{2}$ -ton ZIL-130. Such was also the case with the 1 $\frac{1}{2}$ -ton GAZ-AA, which was replaced by the 2 $\frac{1}{2}$ -ton GAZ-51 and GAZ-52 lorries and to a certain extent by the 4-ton GAZ-53. The large YAZ and MAZ with a 7-ton load capacity began to be produced in the 1950s.

77. The increase in the load capacity of the rolling stock caused a sharp reduction in the cost of transport operations and a rise in productivity. For example, the cost of a 50 kilometre transport operation using a 13-ton articulated lorry under average conditions has now been reduced by 25% in comparison with operations using the 4-ton ZIL-164. The drivers' productivity has increased three times. It therefore follows that larger tonnage lorries should be used for the transport of heavy loads. Thus, the growth of freight transport operations was influenced by the load capacity of lorries, and the development of a standardized range of heavy lorries and articulated lorries.

78. The national economy requires extensive transport of both indivisible light-weight loads and loads consisting of small parts (for trade, communications and industrial loads). Medium tonnage lorries are unsuitable for such transport operations. Thus, the transport of a 1 $\frac{1}{2}$ -ton load on 2 $\frac{1}{2}$ -ton lorries costs 15% more than transport by a 1 $\frac{1}{2}$ -ton truck. There is therefore a need to develop standardized small tonnage, i.e. 400, 1,000 and 1,500 kg trucks.

79. Country roads are often impassable by 4-wheeled vehicles in autumn, spring and winter. According to information supplied by the Ministry of Road Transport and Highways of the RSFSR, up to 200,000 vehicles a year are put out of action

because of bad road conditions. The automobile industry must therefore develop a standardized range of improved and heavy-duty lorries.

80. Specialized vehicles (i.e. trailers and semi-trailers with tip-up and tank bodies, various types of vans and refrigerated lorries) had to be developed for transporting mass loads (such as coal, gravel, sand, and unpackaged materials - cement, flour, liquids, industrial goods and agricultural products). Lorries and semi-trailers with special chassis had to be developed for transporting large heavy-weight girders, walls, roofs and other items for industrial and home construction. Heavy-duty 27 - 65 - 110 ton tip cabs were produced for quarry work and hydro-electric power station construction. Thus, various types of vehicles were developed to meet road transport requirements.

81. Following are recommendations for the lorry tonnage system for future use (1970-1980) in the USSR, based on a study made by the Scientific Research Automobile Transport Institute on planned load capacity and unaccepted standard automobile designs.

Table 5
Lorryload tonnage system for 1970 - 1980

<u>Load Capacity Groups,</u> <u>in tons</u>	<u>Percentage of total all sizes</u>	
	<u>1970</u>	<u>1980</u>
Small, up to 2 tons	22.3	24.1
Medium, from 2.1 to 5 tons	31.6	31.7
Large, from 5.1 to 16 tons	45.0	41.2
Extra large, over 16.1 tons	<u>0.6</u>	<u>3.0</u>
Total all sizes	100.0	100.0

In 1970, trailers and semi-trailers represented 46 per cent of all road transport (25% trailers, 21% semi-trailers). By 1980 it is estimated that such transport will represent 41 per cent of all road transport (22% trailers and 19% semi-trailers).

82. The number of semi-trailers should, as a general rule, be one and a half times greater than the number of tractors. Trailer tonnage is recognized as being equal to that of the lorry for which the trailers are designed, while for semi-trailers it is double the tonnage of the lorries on which the tractors are based.

83. Within the centralized Soviet system of technical road transport control which is effected by the Ministry of Automobile Transport and Highways of the RSFSR, all the requirements of operating organizations relating to the standardization of automobile production are studied and publicized by the Ministry's Scientific Research Institute. These requirements are sent to the Automobile Industry Ministry and form the basis for plans for the future technology and structure of the industry.

VIII. THE SIGNIFICANCE OF AUTO OBILE MAINTENANCE AND HOW IT CAN HELP TO INCREASE THE PRODUCTIVITY OF AUTOMOBILE TRANSPORT WORKERS

84. As has been shown above, freight and passenger transport must be increased 1.6 and 1.9 times respectively under the Five Year National Economy Development Plan for 1966-1970. The average number of manual and white collar workers in automobile transport increases every year; and has reached today considerable proportions. In order to prevent this increase, ways and means of raising their productivity must be examined.

85. As mentioned earlier, one effective way of increasing productivity in automobile transport is the rational standardization of the structure of rolling stock components in order that the least number of transport operations and therefore the smallest number of maintenance staff should be required. Productivity could also be increased by reducing labour costs for maintenance and repairs. Research has shown that an unnecessary amount of labour is expended on such work. Careful studies of this question, made by scientific research establishments, show that:

- (a) The present labour consumption of technical maintenance and automobile repairs could be reduced to a level of (over a distance of 1,000 km) 5 to 5¹/₂ hours for medium engine passenger cars; 9 to 11 hours for medium sized buses; and 6 to 7 hours for medium tonnage lorries;
- (b) Technical servicing should be done more frequently and should consist of daily maintenance and periodic technical servicing (PTS) to be carried out every 15,000 to 20,000 km.

86. In order to reduce the labour force for technical maintenance and automobile repairs in the near future, certain measures of broad significance for the national economy are contemplated, such as: the improvement of existing roads and the construction of new hard covered roads; the construction of production bases and service stations and reconstruction of existing ones by the introduction

of new equipment for mechanical repairs and servicing; the increased production of spare parts and high grade oils; and improved technical performance. The plan for improving automobile design includes the following basic measures:

(a) For lubricating work

- i) Frequent oil changes as a result of improved unit design and better quality oil;
- ii) Reduction of the labour consumed in car chassis lubrication by using bearings which do not require lubricating and which protect the lubricated components from dust, dirt, dampness, and water while the automobile is in motion;
- iii) Use of self-lubricating mechanisms and other such measures.

(b) For joining work

- i) Reduction of the variety of joining parts through standardization;
- ii) Increased stability and reliability of the joining units by improving the quality of the materials used and also by using reliable stopping methods, automatic screws, etc.

(c) For regulation work

- i) Using simple automatic brakes;
- ii) Increasing the frequency of servicing brakes and clutch linings;
- iii) Increasing the reliability and stability of the valve mechanism;
- iv) Providing stable and reliable front wheel mechanisms which will last for at least 20,000-25,000 km; and other methods.

(d) For electro-technical work

Increasing the stability and reliability of electro-technical work, etc.

(e) For tyre servicing

Spending at least half the time on tyre servicing.

These measures should reduce the labour consumption of technical maintenance and automobile repair, and increase the productivity of workers engaged in such work.

IX. THE INFLUENCE OF AUTOMOBILE TRANSPORT ON THE DEVELOPMENT OF ROAD CONSTRUCTION AND ALLIED INDUSTRIES IN INDUSTRY

87. Automobile transport was non-existent in Soviet Russia. Short distances were made by carts, hard clay roads were not needed. The Soviet government inherited from Czarism a grand total of 23,000 km of hard cobbled roads. The Soviet government's first task was to repair these roads. However, with the development of industry and agriculture (along with the ever increasing number of loads requiring transport) the automobile industry, automobile transport, and suitable roads developed rapidly. The following table shows the influence of automobile transport on the development of road construction:

Table 6
Influence of transport on the development of roads

	<u>Freight turnover in t/km million</u>	<u>Number of loads transported in millions</u>	<u>Average distance of transport operation</u>	<u>Total of hard covered roads in thousand km-</u>	<u>of which the amount improved with a cement and asphalt-concrete covering</u>
1940	8.9	358.6	10.4	143.4	7.1
1964	132	10,240.3	12.9	351.7	113.5

88. This table shows that at a time when the number of loads transported by automobile transport increased 14 times, the length of roads increased 2½ times, and road improvements increased 17 times. In accordance with the directives of the XXIII Congress of the CPSU for the Five-Year Plan for the Development of the National Economy for 1966-1970, 63,000 km of hard covered roads will be built.

89. Road construction is carried out in the Soviet Union by modern road construction machines. The development of the road construction machine industry is shown by the following table:

Table 7
Development of road construction on machine industry

	<u>Hard covered roads (in thousand km)</u>	<u>Number of improved roads</u>	<u>Number of road construction machines produced</u>		
			<u>Bulldozers</u>	<u>Scrapers</u>	<u>Graders</u>
1940	143.4	7.1	113	2,104	33 (in 1950)
1964	351.7	113.5	20,010	6,767	4,110

90. During the five years before the Second World War, more than a hundred different road construction machines, ranging from the simplest trailers to complex units, were produced. In the ten-year period from 1930 to 1940, the gross production of road construction machinery increased 14 times, and from 1940 to 1951, it increased 13.2 times.

91. The Republican Ministry for Construction and Road Machinery, which controls many road construction machinery plants, was set up in 1963. The Ministry is responsible for ensuring the increasing mechanization of all types of road construction work, especially those which consume great numbers of workers by organizing the mass production of the machinery.

92. The growth of automobile transport thus resulted in the increase in the length of the roads and the development of the organization of road construction, as well as of the production of road construction machinery and of the branches involved in the production of roads and construction materials, such as bitumen, cement, lime, metal, stone materials, etc.



Appendix Table A

Types of lorries that carry out transport operations

<u>Name of Automobile</u>	<u>Tonnage in kg</u>	<u>Engine</u>				<u>Highest Speed km/h</u>	<u>Type</u>
		<u>General characteristics</u>	<u>No. of cylinders</u>	<u>Working capacity in litres</u>	<u>HP rating</u>		
1	2	3	4	5	6	7	8
<u>For transport operations on hard covered roads</u>							
Moskvich 433 van	400	4 stroke carburettor in line	4	1.35	50	110	4x2
GAZ-451 van	1,000	same	4	2.44	70	95	4x2
GAZ-451 DM lorry	1,000	same	4	2.44	70	95	4x2
GAZ-52 lorry	2,500	same	6	3.48	75	70	4x2
GZTP-892 bread van	2,240	same	6	3.48	75	80	4x2
GAZ-53A lorry	4,000	4 stroke carburettor V-shaped	8	4.25	115	85	4x2
ZIL-130 lorry	5,500 • 5,000	same	8	6.00	170	20	4x2
ZIL-130B tractor with OdAZ-855 semi-trailer	7,500	same	8	6.00	170	80	4x2
KAZ-608 tractor with KAZ-717 semi-trailer	11,500	same	8	6.00	170	70	4x2
UdAZ-377 tractor with OdAZ-935 covered semi-trailer	13,500	same	8	7.00	180	60	6x4
MAZ-500T lorry with MAZ-5243T trailer	8,000 • 7,000	4 stroke diesel V-shaped	6	11.15	180	80	4x2
MAZ-504 tractor with MAZ-5245 semi-trailer	14,000	same	6	11.15	180	80	4x2
GAZ-53B tip-up cab with 3 collapsible sides for transporting agricultural products	3,500	4 stroke carburettor V-shaped	8	4.25	115	85	4x2
ZIL-MFZ-555 metal covered tip-up lorry	4,500	same	8	6.00	170	80	4x2

Appendix Table A (continued)

1	2	3	4	5	6	7	8
MAZ-503B metal covered tip-up lorry	8,000	4 stroke diesel V-shaped	6	11.15	180	70	4x2
KrAZ-251B metal covered tip-up lorry	14,000	same	8	14.86	240	75	6x4
BelAZ-540 metal covered tip-up lorry	27,000	same	12	22.30	360	55	4x2

For transport operations on roads of all types, and unsurfaced roads

GAZ-6t improved heavy-duty lorry	2,000	4 stroke carburettor V-shaped	8	4.25	115	95	4x4
ZIL-131 heavy-duty lorry	3,500	same	8	6.00	170	80	6x6
URAL-375 heavy-duty lorry	5,000	same	8	7.00	180	75	6x6
KrAZ-255B heavy-duty lorry	7,500	4 stroke diesel V-shaped	8	14.86	240	70	6x6

Appendix Table B

Types of cars that carry out transport operations

<u>Name of automobile</u>	<u>Gen. type</u>	<u>No. of cylinders</u>	<u>Engine working capacity in lts.</u>	<u>HP rating</u>	<u>Compression ratio</u>	<u>Fuel Consumption</u>	<u>Maximum speed</u>
Small engine ZAZ-965A	2 door 4 seater	4	0.637	27 (air cooled)	6.5	5.5 l/100 km	90 km/h
"Moskvich 408"	4 door 5 seater	4	1.35	50 (overhead valve)	7	8-10 l/100 km	120 km/h
Medium-class "Volga"	4 door 4-5 seater	3	2.4	70 (overhead valve)			

"Chaika"^{a/}
 deluxe

"ZIL-III"^{b/}

a/ Produced by Gorki Works

b/ Produced by Moscow Works

Appendix Table C

Types of buses that carry out transport operations

The "RAM-977" 1.5-tonner mini-car, produced by the Rishsk Motor Works;

The small city PLS-612 bus with 25 seats and room for 52, produced by the Pavlovsk Motor Works;

The LIAZ-153 city bus with 32 seats and room for 60, produced by the Likinsk Motor Works;

The "Lvov" city bus, of the same size as the LIAZ-153, but with a rear engine. Two modified types of this bus, a suburban and a tourist bus, are produced by the Lvov Motor Works.

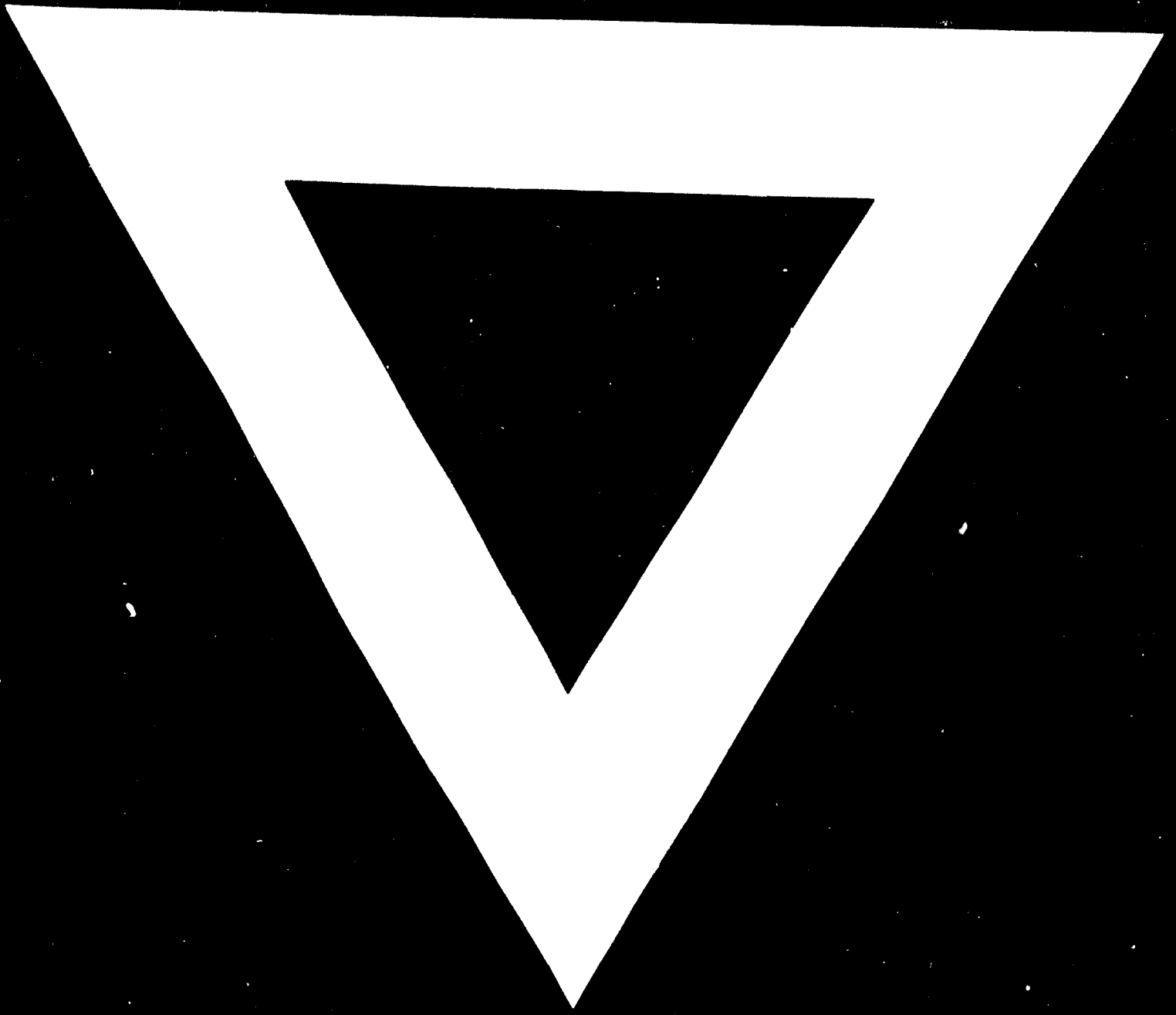
Recently, most motor works have been working on improved car and lorry models, of which the following are the most noteworthy:

The 6 wheeler BELAZ-540 65-ton tip-up lorry for quarry work, produced by the Byelorussian Motor Works;

The medium class Volga-type car with a new improved engine and chassis, produced at the Gorki Motor Works;

The LIAZ-677 large city bus with 25 seats and room for 110, produced at the Likinsk Bus Factory.





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