

FOR OFFICIAL USE ONLY

JPRS L/9720

7 May 1981

# USSR Report

TRANSPORTATION

(FOUO 3/81)

**FBIS** FOREIGN BROADCAST INFORMATION SERVICE

FOR OFFICIAL USE ONLY

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [ ] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

COPYRIGHT LAWS AND REGULATIONS GOVERNING OWNERSHIP OF  
MATERIALS REPRODUCED HEREIN REQUIRE THAT DISSEMINATION  
OF THIS PUBLICATION BE RESTRICTED FOR OFFICIAL USE ONLY.

FOR OFFICIAL USE ONLY

JPRS L/9720

7 May 1981

USSR REPORT  
TRANSPORTATION  
(FOUO 3/81)

CONTENTS

AIR

Operations Research in Civil Aviation (Ivan Semenovich Golubev, et al.; ISSLEDOVANIYE OPERATSIY V GRAZHDANSKOY AVIATSII, 1980) .....	1
Economics of the Aviation Industry (Sergey Aramovich Sarkisyan, David Elkunovich Starik; EKONOMIKA AVIATSIONNOY PROMYSHLENNOSTI, 1980) .....	3
Book on City Air Transportation Services Noted (A. I. Borodach, et al.; GOROD I AVIATSIYA, 1980) .....	6

RAILROAD

New Edition of Soviet Book on Railcars Published (L. A. Shadur; VAGONNY: KONSTRUKTSIYA, TEORIYA I RASCHET, 1980) .....	8
--	---

- a -

[III - USSR - 38d FOUO]

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

AIR

UDC 629.7.338.07.001.(022)

OPERATIONS RESEARCH IN CIVIL AVIATION

Moscow ISSLEDOVANIYE OPERATSIY V GRAZHDANSKOY AVIATSII in Russian 1980 (signed to press 30 Jun 80) pp 2, 256

[Annotation and table of contents from book "Operations Research in Civil Aviation", by Ivan Semenovich Golubev, Radiy Vladimirovich Sakach, Yevgeniy Leonidovich Loginov and Yevgeniy Georgiyevich Pinayev, Izdatel'stvo "Transport", 1700 copies, 256 pages]

[Text] In this book, the problems of operating the civil aviation system are dealt with, the basic productive and service operations are described, and methods of assessing their efficiency based on systems analysis and use of economic and mathematical methods are given. Also discussed are problems in optimization of management and planning of the sector.

This book is intended for scientific workers and may be used by engineers and students in civil aviation VUZ's.

It contains 67 illustrations, 7 tables and a bibliography of 95 titles.

CONTENTS

	Page
Introduction	3
Chapter 1. General Provisions of Theory and Practice	5
1. Subject and Tasks of Operations Research	5
2. General Questions and Principles of Operations Research	8
3. Operations Research Software	18
Chapter 2. Civil Aviation as a Large System	21
1. Role of Air Transportation	21
2. Civil Aviation as an Element of the Unified Transportation System for the Country	23
3. Civil Aviation as a Large System	27
Chapter 3. Management of the Sector	38
1. Essence of Scientific Management	38
2. Organizational System of Civil Aviation	44
3. Automation of Management in Civil Aviation	49
4. Problems of Decision-Making	62

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

Chapter 4. Planning the Development of the Sector	66
1. Planning and Directing Its Improvement	66
2. Principles and Basic Requirements for a System of Complex Planning	70
3. General Scheme of Complex Planning	72
4. Methodology of Developing the Basic Directions for Development of Civil Aviation	75
5. Peculiarities of the Long-Term Plan for Development of Air Transportation and Scheme for Drafting It	77
6. Long-Term Planning	100
7. Use of the Critical Path Method and Programmed Evaluation and Review Technique (SPU) when Drafting the Long-Term Plan	116
8. Realization and Problems of Improvement of the System of Complex Planning	120
Chapter 5. Functioning of the Sector	127
1. Analysis of the Technical System	127
2. Model of Distribution of Means at the Level of the Unified Transportation System	132
3. Models of the Functioning of Air Transportation	137
4. Models of the Functioning of the VTS [possibly Air Transformer Link]	149
5. Model of the Functioning of the Transportation Complex (TK)	161
6. Functioning of the Elements of the Transportation Complex	174
Chapter 6. Methodology of Forming the System of Civil Aviation Equipment Resources for the Long Term	201
1. Role and Place of the Problem of Forming Equipment Resources when Drafting the Civil Aviation Development Plan	201
2. Complex of Tasks of Planning the Development of Equipment Resources	203
3. Main Problems--Large Scale, Uncertainty. Overcoming Them	207
4. Fundamentals of Developing Scenarios	211
5. Forecasting Passenger Traffic in Air Transportation	213
6. Aggregating Source Data on Conditions of Operation of the Passenger Aircraft Fleet	224
7. Forming Alternative Versions of Appearances of Future Passenger Aircraft	228
8. Technique for Optimization of the Structure of the Future Fleet of Main Line Passenger Aircraft	232
References	252

COPYRIGHT: Izdatel'stvo "Transport", 1980

8545  
CSO: 1829

FOR OFFICIAL USE ONLY

AIR

ECONOMICS OF THE AVIATION INDUSTRY

Moscow EKONOMIKA AVIATIONNOY PROMYSHELENNOSTI in Russian 1980 (signed to press 22 Apr 80) pp 2, 366-368

[Annotation and table of contents from book "Economics of Aviation Industry", by Sergey Aramovich Sarkisyan and David Elkunovich Starik, Izdatel'stvo "Vysshaya shkola", 10000 copies, 368 pages]

[Text] In this textbook, the basic questions of the economics of the aviation industry are dealt with. Covered are the role of the aviation industry in the national economy and in defense of the country, and the scientific principles of management and planning of the sector. A major part is devoted to the questions of the economics of scientific and technical progress and to the economic substantiation of decisions made at the stages of development, production and operation of aviation systems. Pointed out are ways and means of raising production efficiency, labor productivity and work quality.

Designed for VUZ students of aviation specialties.

CONTENTS		Page
Introduction. Subject and Tasks of the Course		3
Section I. The Aviation Industry in the USSR National Economy		11
Chapter 1. Role of Aviation Industry in the National Economy and its Sectorial Structure		11
1. Basic Stages of Development of the Aviation Industry		11
2. Features of the Aviation Industry and Its Structure		18
Chapter 2. Management of the Aviation Industry		25
1. Essence, Content and Principles of Management		25
2. Structure of Management of the Aviation Industry. Agencies of State Management of Socialist Industry		30
3. Improving Management of the Aviation Industry		35
4. Management Methods		38
5. Systems Approach to Management of Industry		40
6. Methods of Making Decisions		44
7. Automated System for Management of the Sector		50
Chapter 3. Planning the Aviation Industry		65
1. Essence and Principles of Socialist Planning		65
2. System of Plans and Forecasts of the Sector		67

## FOR OFFICIAL USE ONLY

3. Procedure for Compiling Plans for Economic and Social Development	73
4. Five-Year and Annual Plans for Economic and Social Development of the Sector	75
5. Methods of Planning	78
6. Use of Economic and Mathematical Methods in Planning Development, Specialization and Siting of Industry	84
Chapter 4. Planning Production of Sector Output	87
1. Planning Production of Output in Physical and Cost Terms	87
2. Planning Production Capacity and Utilization of It	93
Chapter 5. Concentration, Specialization, Cooperation and Combination of Aviation Production	99
1. Concentration of Production	99
2. Specialization of Production	102
3. Production Cooperation	108
4. Production Combination	110
5. Siting Enterprises of the Sector	111
Section II. Resources of the Sector and Utilization of Them	114
Chapter 6. Fixed Capital and Capital Construction	114
1. Classification, Structure and Methods of Assessing Fixed Capital	114
2. Depreciation and Amortization of Fixed Capital	118
3. Indicators of Utilization of Fixed Capital	123
4. Capital Construction	128
Chapter 7. Sector Working Capital, Supply of Materials and Equipment, and Sales	137
1. Composition, Structure and Sources of Working Capital	137
2. Setting Norms of Working Capital	141
3. Indicators of Utilization of Working Capital	144
4. Organization of Supply of Materials and Equipment and Sales in the Sector	146
Chapter 8. Personnel, Labor Productivity and Wages in the Sector	152
1. Sector Personnel	152
2. Labor Productivity	155
3. Wages	164
4. Wage Fund	177
Section III. Production Cost and Product Pricing. Cost Accounting and Finances of the Sector	180
Chapter 9. Production Cost of Output	180
1. Production Cost of Output and Its Composition	180
2. Distribution of Outlays by Product Type	182
3. Indicators of Production Cost	188
4. Planning of Production Cost	188
Chapter 10. Profit and Pricing in the Sector	196
1. Profit and Profitability	196
2. Prices of Products	200
Chapter 11. Cost Accounting and Finances of the Sector	207
1. Principles of Cost Accounting	207
2. Economic Incentive Funds	209
3. Sector Finances	212

FOR OFFICIAL USE ONLY

Section IV. Economics of Scientific and Technical Progress	224
Chapter 12. Methods of Determining Economic Efficiency of Social Production	224
1. System of Indicators of Efficiency of Social Production	224
2. Determining Economic Effectiveness of Capital Investment	227
Chapter 13. Scientific and Technical Progress in the Sector, Forecasting and Planning of It	235
1. Concept of Scientific and Technical Progress	235
2. Basic Directions and Features of Scientific and Technical Progress in the Aviation Industry	239
3. Forecasting Scientific and Technical Progress	255
4. Planning the Development of Science and Technology	292
Chapter 14. Economic Efficiency and Stimulating Scientific and Technical Progress	294
1. Methodological Principles of Determining Economic Efficiency of New Equipment	294
2. Principles of Forming Criteria to Assess Efficiency of Systems of Flying Vehicles	303
3. Methods of Determining Economic Efficiency of Aviation Transportation Systems (ATS)	311
4. Methods of Economic Evaluation of Systems of Military Flying Vehicles	331
5. Methods of Determining Effectiveness of Scientific Research	335
6. Economic Stimulation of Scientific and Technical Progress	343
Chapter 15. Economics of Product Quality	350
1. Concept and Essence of Product Quality	350
2. Economic Effectiveness of Raising Aviation Equipment Quality	355
3. Product Quality Control	360
Bibliography	364

COPYRIGHT: Izdatel'stvo "Vysshaya shkola", 1980

8545  
CSO: 1829



FOR OFFICIAL USE ONLY

AIR

UDC 711.553.9+725.39

BOOK ON CITY AIR TRANSPORTATION SERVICES NOTED

Moscow GOROD I AVIATSIYA in Russian 1980 (signed to press 16 May 80) pp 2, 182-183

[Annotation and table of contents from book "City and Aviation", by A. I. Borodach, B. N. Mel'nikov, V. I. Chernikov and O. I. Berdnik, Stroyizdat, 183 pages]

[Text] This book contains basic data on air transportation facilities established to service the city: airports for modern aircraft and flying vehicles with short and vertical takeoff and landing; heliports and city air terminals. Discussed are the requirements for locating air transportation facilities with respect to the city with regard to ensuring convenient interaction with it, preventing the unfavorable effects of aviation noise on the population, ensuring conditions for efficient operation of air transportation facilities and observing requirements for airship flight safety. Dimensions of territories needed for construction of airports, heliports and city air terminals are given. Basic principles for organizing passenger transportation between the city and the airport are set forth.

This book is intended for architects and specialists working in city building and planning of air transportation facilities.

It contains 40 tables, 87 illustrations and a bibliography with 22 titles.

CONTENTS		Page
Introduction		3
Chapter 1. The City and Air Transportation		5
1. Aviation Transportation Capabilities		5
2. Siting of Air Transportation Structures and Systems in City Transportation Centers		12
Chapter 2. Airports		17
1. Airport Classification		17
2. Airport Structures and Systems		23
3. Airport Siting		44
4. Basic Provisions of Carrying Out General Plans for Airports		51

FOR OFFICIAL USE ONLY

Chapter 3. Heliports and Airports for Aircraft with Short and Vertical Takeoff and Landing	60
1. Purpose of Heliports	60
2. Basic Elements and Classification of Heliports	67
3. Land Dimensions	69
4. Heliport Siting	72
5. Basic Provisions for Carrying Out General Plans for Heliports	83
6. Airports for Aircraft with Short and Vertical Takeoff and Landing	88
Chapter 4. City Air Terminals	96
1. Purpose and Classification of City Air Terminals	96
2. Structures, Planning Organization and Dimensions of City Air Terminals	101
3. City Air Terminal Siting	111
Chapter 5. Effect of Air Transportation on the Environment	123
1. Features of the Effect of Aviation Noise and Questions of Setting Norms for It	123
2. Comparative Assessment of Modern Aircraft Noise Characteristics, Questions of Classification of Them	135
3. Main Sources of Aircraft and Helicopter Noise and Methods of Reducing It	144
4. Restricting Building in Airport Environs Because of Noise Created by Aircraft and Helicopters	150
Chapter 6. Organizing Transportation Between Airports and the City	165
Bibliography	180

COPYRIGHT: Stroyizdat, 1980

8545  
CSO: 1829

FOR OFFICIAL USE ONLY

RAILROAD

NEW EDITION OF SOVIET BOOK ON RAILCARS PUBLISHED

Moscow VAGON: KONSTRUKTSIYA, TEORIYA I RASCHET in Russian 1980 signed to press 18 Aug 80 pp 2-7, 14-15, 437-440

/Annotation; excerpt of introduction; chapter 1, section 1; excerpt of chapter 1, section 3; and table of contents from book by L. A. Shadur, doctor of technical sciences, professor: "Railroad Cars: Design, Theory and Analysis", Izdatel'stvo "Transport", third edition, revised and expanded, 15,500 copies, 439 pages/

/Text/ Annotation

This book describes the equipment, the selection of technical-economic parameters and overall dimensions and also the modern methods of analyzing railcars for strength. In comparison with the second edition, the third edition has been revised and expanded in connection with changes that have taken place in the designs, ratings and methods of designing railcars in recent years.

The book is to be used by students in railroad institutions of higher learning. It can also be used by engineering and technical workers in the railroad car maintenance facilities and in the railroad car building industry, who are engaged in designing, operating and repairing railroad cars.

/Excerpt from introduction/

Students specializing in "railroad car building and railcar facilities" study "Railroad cars", which deals with:

- designs of railcars and their assemblies, which differ in variety and in some cases in considerable complexity;
- ratings of railcar parts for strength and stability;
- the fundamentals of designing railroad cars (selection of technical-economic parameters, overall dimensions), methods of testing railcars and their assemblies.

These matters are studied in lectures, in laboratory and practical studies, in production practice, and in performing course and degree projects.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

The study discipline "Railroad cars" is based on knowledge gained by students when studying other disciplines of the their course work, especially higher mathematics and theoretical and construction mechanics. In turn, the "railroad cars" course is the basis for studying subsequent disciplines such as "Railroad car dynamics", "Containers", "Refrigeration equipment of railroad cars and air conditioning", "Automatic brakes", "Railroad car electrical equipment", "Technology of railroad car building and the repair of railcars", "Organization and planning of production at railroad car building and repair enterprises", "Automatic equipment and the automation of production processes", "Railroad car management" and others. In addition, many of the theories of these disciplines are used in the "railroad cars" course.

Since the first and second editions of this textbook were published, important scientific research has been done, new designs of railroad cars and their assemblies have been developed, and there have been changes in the study plans of the institutes. All of this is reflected in this new edition of the textbook, which differs from the earlier editions in the following areas:

- a more complete outline of the theory of reliability and service life in regard to railroad car designs. In the fourth and other chapters methods for evaluating the fatigue strength of railroad car parts are outlined, including ways to evaluate the strength reliability of the elements of the railroad car design;

- an outline of the ratings of railroad cars using computers, which provide the receipt of more complete and precise solutions when reducing labor intensiveness. Digital computers are used to determine the optimal parameters of freight cars, to calculate the carriage underframes, the boilers of tank cars and others which bear the basic loads of a railroad car's elements;

- a justification for the new designs of railroad cars and their parts. In particular, chapters 11, 12 and 13 have been expanded, which are devoted to designs of freight and passenger railroad cars, and also chapters 5, 7 and 10 and others (hollow axels, pneumatic shock absorber suspensions, new automatic uncouplers, absorption equipment, etc.);

- an outline of new methods for analyzing the parts of railroad cars (analyzing the axels of wheel pairs, three-layer walls of railroad car bodies, and boilers of tank cars and others);

- the development of methods for the economic analysis of railroad car designs.

In connection with this chapter 3 was significantly expanded to include a description of a new methodology for determining the basic parameters of a railroad car. Other chapters of the textbook also contain technical-economic analysis.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

As in previous editions, the textbook includes reference material which direct the student to sources that provide more information or that for the first time ever outline the question being studied. Learning materials and other literature are also indicated which contain examples of calculations, reference data and so forth.

This textbook structure was chosen not only in response to the problems of outlining an extensive course in a comparatively small volume, but also out of a desire to awaken in the student a wish to pursue independent study of some topic or another thereby helping the engineer to acquire the skills that he so needs in this work.

As in previous editions of this textbook, the international system of units was used. In particular, voltage and pressure are expressed in pascals (Pa) or in megapascals (MPa). In many cases when translating old units into new figures are rounded to 2 percent, i.e.,  $1 \text{ kgs/mm}^2 \approx 10 \text{ Mpa}$  and  $1 \text{ kgs/cm}^2 \approx .1 \text{ MPa}$ . Since this rounding is used in both estimated and allowable voltages, it is not reflected in the accuracy of the results.

The carrying capacity of a railroad car, as a measure of the maximum cargo carrying capacity, is expressed in units of mass, i.e., in kilograms (kg) or tons (t). However, when analyzing railroad cars for strength and studying railroad cars for vibrations and for other calculations, the carrying capacity is expressed in newtons (N), kilonewtons (kN) or meganewtons (MN) based on the relationship between mass and force, i.e., by multiplying the mass by the acceleration  $g$ .

The railroad car container, viewed as its mass, is expressed in kg or t. In strength and other calculations, the container is expressed as the weight (force of gravity) in N, kN or MN.

The linear load, which represents the relationship of the sum of the carrying capacity and container to the length of the railroad car, is used to determine the mass of the train and is expressed in kilogram-meters or ton-meters. In calculating the strength of bridges and other such calculations, results are expressed in newton-meters, kN-meters and MN-meters.

Axle load is used in a similar way. However, since axle load is used in the textbook predominately to evaluate the strength of wheel pairs and other railroad car parts, this parameter is given in kN.

In preparing the new edition of the textbook the authors received valuable advice and comments from their co-workers of the departments of "railroad cars and the railroad car service" of the transportation institutes, scientific-research institutes, railroad car building plants and others. The authors are greatly indebted to them all for their help in improving the textbook.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

## Chapter 1. General Information on Railroad Cars

## 1.1 Description of the Railroad Car Park and Its Classification

Railroad transport, which is the basic form of transportation in the USSR, is very important to the Soviet Union. The normal operation of railroad transport requires the appropriate development and smoothness of operation in all of its links - sectors. The railroad car service and its foundation, the railroad car park, is one of the most important and complex sectors of railroad transport.

A unit of railroad rolling stock used to convey passengers or cargo is called a railroad car.

Of great importance are the efficiency of railroad car designs and their technical-economic indicators, which determines the convenience of conveying passengers, the carrying capacity of the railroads, the feasibility of extensively adopting comprehensive mechanization and automation when manufacturing and repairing railroad cars, and also their operation (the formation of trains, carrying out loading and unloading operations and so forth), and the amounts of capital investments and the cost of shipments.

The present-day railroad car park is remarkable for its diversity in types and designs. This is made necessary by the need to satisfy various requirements for shipments: the greatest carrying capacity of railroads, providing for the comfort of passengers, preserving the valuable qualities of perishable cargoes, preventing damage to fragile cargoes, protecting cargoes from moisture, universality, the maximum use of cargo carrying capacity and others.

These factors determine the complexity of railroad car designs, which are equipped with automatic braking systems, automatic coupling systems, undercarriages, which ensure motion at high speeds, the necessary smoothness, little resistance and so forth. Depending upon their use, railroad cars are equipped with thermal insulation, heating, refrigeration, air conditioning, electrical equipment and other devices.

Modern forms of traction make it possible to form heavy freight trains, to develop high speed motion and to make non-stop runs over great distances. This determines the requirements to ensure reliability and long service life of railroad car designs, to monitor their condition within short periods of time, including in inconvenient conditions of the inspection at the railroad stations. Traffic safety is the most important requirement upon the layout and maintenance of railroad cars.

There are railroad cars that are not self-propelled, which can only be moved by locomotives. There are also self-propelled railroad cars, which are called railway motor cars; these cars have their own power plant for motion (motor cars, transfer-cars, diesel trains) or they receive power from a contact grid (electric trains, metro cars).

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

Railroad cars are broken down by purpose, technical description and place of operation.

Railroad cars are broken down into two basic groups - passenger and freight cars.

A passenger car has a body, which is a closed facility with all basic equipment needed for passengers (equipment for sitting or reclining, heating, air conditioning and ventilation systems, toilets, convenient entrances and exits and so forth).

The passenger car park consists of cars for conveying passengers, dining cars, mail, baggage and special purpose cars.

Depending upon the distance of conveyance passenger cars differ in their layout. Passenger cars are broken down as follows:

-long distance, for conveying passengers over long distances. There are both compartmented and non-compartmented passenger cars. They are equipped with "hard" and "soft" benches for reclining and are therefore called "hard" or "soft" cars;

-local transport, for conveying passengers over shorter distances, predominately during the day. These cars have convenient seats for sitting;

-suburban, for conveying passengers over short distances within a relatively short period of time (1 - 2 hours); they are equipped with benches (hard or semi-hard) for sitting;

dining cars, for feeding passengers during their journey. The car has a room for eating, a kitchen, pantries for refrigerating and storing food stuffs and other sections;

-mail cars, for conveying mail cargo. The car has storage rooms and a large room for postal operations and facilities for service personnel;

-baggage cars, for conveying the baggage of the passengers on the train. These cars have storage rooms with loading and unloading equipment and facilities for service personnel;

-mail and baggage cars are used as mail and baggage cars on sections of railroads that convey small numbers of passengers.

Special purpose passenger cars include laboratory cars, duty cars, sanitation cars, club cars and so forth.

Depending upon the type of cargo transported, freight cars are broken down as follows:

-covered freight cars are used to transport grain and other friable cargoes, requiring protection from precipitation, and for transporting packaging materials and valuable cargoes. The car has an enclosed body and is usually equipped with hatches and doors.

FOR OFFICIAL USE ONLY

-gondola cars are used to transport bulk freight (ore, coal, fluxes, timber, and so forth), containers, various equipment and so forth. The car has an open body, and is usually equipped with doors and unloading hatches;

-flat cars are used to transport long and bulky cargoes (timber, sheet metal, construction materials and unfinished construction materials), containers, motor vehicles, etc. These cars have floor boarding on a frame and usually sides that can be lowered;

tank cars are used to transport liquid and gaseous cargoes (oil, kerosene, gasoline, lubricants, compressed gases, etc.) The railcar body serves as a special reservoir (boiler), usually cylindrical in shape, which has hatches for filling and emptying the cargo;

-isothermal cars are used to transport perishable freight (meat, fish, milk, fruit and so forth). The body of these cars have insulation and equipment for creating the needed temperature and humidity levels. Present-day isothermal cars are constructed in the form of independent refrigeration sections with a central cooling plant or a complete set of cooling equipment in each car (independent refrigerator car). Previously we had railroad cars with ice-salt cooling;

-special purpose freight cars are used to transport freight that requires special handling. This group of cars includes transporters for carrying heavy and bulky cargoes, motor vehicle carriers, cars for carrying cement, cattle and other specific freight. There are also railroad cars which are used by the railroads themselves (railroad car shops, and railroad cars for auxiliary and fire trains and others).

Depending upon their technical description, passenger and freight cars are further broken down as follows:

-by number of axles -2-,4-,6-, 8-, and multi-axle cars. There are both bogie and non-bogie railroad cars;

-by material and manufacturing technology of the body - all-metal, with wooden or metal shell, basically welded with individual riveted units;

-by carrying capacity, size of container, load upon the wheel pair on the rails, load on one meter of track and other parameters;

-by size of rolling stock, to which they comply, and by width of the railroad gauge - wide-gauge and narrow gauge.

By place of operation railroad cars are broken down into general line-operated and industrial transport. General line-operated railroad cars are permitted to operate on the entire railroad network of the USSR. Industrial transport railroad cars, if their designs fully comply with norms for calculations for strength and for railroad car designing of mainline railroads and with the requirements of the Rules of technical operation (PTE), are permitted on the tracks of the USSR Ministry of the



FOR OFFICIAL USE ONLY

Railways. Railroad cars of other designs, which do not comply with these requirements, can be operated only on intra-plant tracks and on other closed industrial tracks.

Excerpt of Chapter 1, Section 37

In 1971 - 1975 railroad transport received 373,000 mainline freight cars, which was 1.5-fold more than in the previous five-year period. Industrial transport was also equipped with special railroad cars with an increased carrying capacity. At this stage the fitting out of the passenger car park with improved, comfortable, all-metal cars was completed. Railroad transport received 15,400 such railroad cars during the five-year plan.

A great deal of attention was devoted to improving the technical status of the operational park of freight cars through modernization: equipping the axle boxes with roller bearings, replacing wooden shells on gondola cars with metal shells, equipping covered freight cars with self-sealing doors, replacing flanged bogies with bogies having cast side frames and above-shock beams, and also replacing outdated brake designs with improved versions. During this period extensive theoretical and experimental research was conducted, which resulted in the building of experimental models of new passenger and freight cars. The Kalinin railroad car building plant produced a series of railroad cars for the "Russkaya troyka" train (RT200), which is to operate at a speed of 56 meters per second (200 kilometers per hour). The freight car park is being augmented with progressive types of railroad cars - 8-axle gondola cars and tank cars, all-metal covered freight cars, new refrigerator sections and motorized cars and flat cars for transporting large-cargo containers, and others.

TABLE OF CONTENTS

- Introduction ..... 3
- Chapter 1. General Information on Railroad Cars
  - 1.1 Description of the railroad car park and its classification .... 5
  - 1.2 Basic elements of a railroad car design ..... 7
  - 1.3 Development of the railroad car park of Soviet railroads ..... 8
- Chapter 2. Dimensions
  - 2.1 Basic definitions ..... 17
  - 2.2 Railroad car dimensions ..... 19
  - 2.3 Inscribing the dimension of a railroad car ..... 24
- Chapter 3. Technical-Economic Parameters of Freight Cars
  - 3.1 The need for economic research and selection of freight car type 30
  - 3.2 Parameters of freight cars ..... 33
  - 3.3 Relative volume and space ..... 33
  - 3.4 Tare-load ratio of a railroad car ..... 37
  - 3.5 Carrying capacity and linear load of a railroad car ..... 43

FOR OFFICIAL USE ONLY

3.6 Linear sizes of a railroad car ..... 44  
3.7 Sequence for determining the basic parameters of a railcar .... 45

Chapter 4. Basic Data for Analyzing Railroad Cars for Strength and Evaluating the Reliability of the Elements of Railroad Car Design

4.1 Loads affecting a railroad car ..... 51  
4.2 Materials that are used and allowable stresses ..... 57  
4.3 Basic principles and concepts of the theory of reliability .... 69  
4.4 Quantitative characteristics of reliability ..... 71  
4.5 General analytic relationships for calculating reliability indicators ..... 72  
4.6 Laws of time distribution of failure-free operation. Failure flows ..... 73  
4.7 Time distribution of failure-free operation for certain elements of railroad car design ..... 77  
4.8 Rating reliability indicators when designing ..... 79

Chapter 5. Wheel Pairs

5.1 Purpose, classification and basic sizes of wheel pairs ..... 88  
5.2 Axles ..... 90  
5.3 Wheels ..... 95  
5.4 Diameter and thickness of wheel rims ..... 99  
5.5 Joining the wheel to the axle ..... 101  
5.6 Increasing the strength and reliability of the axle of a wheel pair ..... 104  
5.7 Forces affecting the wheel pair ..... 105  
5.8 Rated loads and conditions of loading wheel pair axle ..... 110  
5.9 Axle rating for endurance during non-stationary loading ..... 111  
5.10 Simplified methods for rating an axle ..... 116  
5.11 Several hypotheses on the rating-experimental evaluation of wheel strength ..... 118

Chapter 6. Axle Boxes

6.1 Purpose and classification of axle boxes ..... 121  
6.2 Axle boxes with roller bearings ..... 121  
6.3 Rating roller bearings ..... 127  
6.4 Conditions for the safe operation of axle boxes with anti-friction bearings ..... 130  
6.5 Axle boxes with plain bearings ..... 132  
6.6 Rating plain bearings ..... 136  
6.7 Economic efficiency of converting freight car axle boxes to roller bearings ..... 138

Chapter 7. Shock Absorbers, Springs and Dampers

7.1 Purpose and varieties of shocks, springs and dampers ..... 140  
7.2 Designs of springs and compound shocks ..... 140  
7.3 Rated loads, materials and allowable stresses ..... 142  
7.4 Elasticity and force characteristics of springs and shocks ... 143  
7.5 Rating of torsion springs ..... 147

FOR OFFICIAL USE ONLY

7.6	Rating springs during horizontal and vertical loading .....	150
7.7	Compression springs .....	151
7.8	Rating springs for endurance .....	153
7.9	Torsion and rings shocks .....	157
7.10	Rating compound shocks .....	158
7.11	Design and rating of rubber shocks .....	159
7.12	Pneumatic shocks .....	163
7.13	Dampers .....	165

Chapter 8. Bogies

8.1	Purpose and classification of bogies .....	176
8.2	Revolving and stable layouts in bogies .....	179
8.3	Placement of dampers in bogies .....	180
8.4	Freight car bogies .....	182
8.5	Passenger car bogies .....	187
8.6	Requirements made on bogies .....	192
8.7	Forces affecting a bogie .....	193
8.8	Rating the cast side frame of a 2-axle freight car bogie .....	197
8.9	Rating the cast side frame of a 2-axle bogie by computer .....	204
8.10	Rating the above-shock beam of a bogie .....	210
8.11	Features of rating the parts of three- and four-axle freight car bogies .....	212
8.12	Rating the frames of passenger car bogies .....	214
8.13	Rating the parts of the cage .....	220
8.14	Evaluating the fatigue-strength of frames, above-shock beams and other parts of bogies .....	224

Chapter 9. Railroad Car Bodies

9.1	Classification and basic principles of layout .....	227
9.2	Basic hypotheses on rating bodies .....	230
9.3	Work features and stability of the elements of the body with the carrier shell .....	232
9.4	Rating a freight car body .....	236
9.5	Special features of rating the body with the carrier design in the form of a three-layer shell .....	243
9.6	Approximate rating of a passenger car body .....	249
9.7	Precise ratings of a passenger car body .....	252
9.8	Rating stresses in belts of passenger car body of the closed shell type .....	256

Chapter 10. Impact-traction Instruments

10.1	Purpose and classification of impact-traction instruments .....	260
10.2	Automatic coupling layout. Autocoupler casing .....	262
10.3	Rating the casing of autocoupler for low-cycle fatigue and probability of fracture .....	264
10.4	The SA-3 autocoupler .....	266
10.5	Modernized and standardized autocouplers .....	270
10.6	Uncoupler drive, impact-centering device, draw gear and bearing parts .....	272

FOR OFFICIAL USE ONLY

10.7	Foreign autocouplers .....	276
10.8	Purpose and parameters of absorption equipment .....	277
10.9	Spring-friction equipment .....	279
10.10	Power characteristics and power consumption of equipment ...	282
10.11	Structure of power characteristics of spring-friction equip- ment .....	285
10.12	Ways to increase power consumption and provide stability to spring-friction equipment .....	286
10.13	Absorption equipment with rubber elements .....	287
10.14	Hydraulic absorption equipment .....	289
10.15	Recoil platform .....	291
10.16	Parameters of placing an autocoupling device and conditions for coupling autocouplers .....	293
 Chapter 11. Freight Cars		
11.1	Technical requirements for basic types of freight cars .....	298
11.2	Closed cars .....	299
11.3	Gondola cars .....	310
11.4	Flat cars .....	318
11.5	Hoppers and other bunker-type railroad cars .....	322
11.6	Transporters.....	325
11.7	Industrial transport railroad cars and narrow-gauge railroad cars .....	328
11.8	Features of some freight cars on foreign railroads .....	333
11.9	Ways to further develop freight car designs .....	337
 Chapter 12. Tank Cars		
12.1	Classification of Tank Cars .....	339
12.2	General purpose tank cars .....	340
12.3	Special tank cars .....	348
12.4	Pouring devices and safety valves .....	361
12.5	Rating the boiler of a tank car .....	363
12.6	Precise rating of stresses in the cylindrical parts of the boilers .....	367
12.7	Requirements placed upon the moving parts of tank cars .....	378
 Chapter 13. Passenger Cars		
13.1	Technical requirements upon passenger cars .....	379
13.2	Types, basic parameters and layouts of passenger cars .....	381
13.3	Bodies of the railroad cars .....	386
13.4	Interior equipment of passenger, duty and housekeeping facili- ties .....	402
13.5	Water supply in railroad cars .....	407
13.6	Features of passenger cars of foreign railroad systems .....	410
13.7	Tendencies in the design developments of passenger cars .....	412

FOR OFFICIAL USE ONLY

Chapter 14. Fundamentals of Designing, Building and Testing Railroad Cars

14.1	Stages in designing, manufacturing and testing railcars .. .	415
14.2	Problems in testing railroad cars and the basic hypotheses of the methodology for doing the testing .....	418
14.3	Varieties of guages and measuring equipment .....	419
14.4	Some features of static testing for strength .....	421
14.5	Choosing a place to place guages for determing stresses ....	422
14.6	Tests for longitudinal impact loads. Vihration tests .....	425
14.7	Using statistical methods and special equipment in experimen- tal research .....	427
	Bibliography .....	430
	Index .....	434

COPYRIGHT: Izdatel'stvo "Transport", 1980

8927  
CSO: 1829/191

END

FOR OFFICIAL USE ONLY