

ENGINEER



international scientific journal

ISSUE 3, 2026 Vol. 4

E-ISSN

3030-3893

ISSN

3060-5172



SLIB.UZ
Scientific library of Uzbekistan



A bridge between science and innovation



**TOSHKENT DAVLAT
TRANSPORT UNIVERSITETI**

Tashkent state
transport university



ENGINEER

A bridge between science and innovation

E-ISSN: 3030-3893

ISSN: 3060-5172

VOLUME 4, ISSUE 3

SEPTEMBER, 2026



engineer.tstu.uz

TASHKENT STATE TRANSPORT UNIVERSITY

ENGINEER

INTERNATIONAL SCIENTIFIC JOURNAL
VOLUME 4, ISSUE 3 SEPTEMBER, 2026

EDITOR-IN-CHIEF

SAID S. SHAUMAROV

Professor, Doctor of Sciences in Technics, Tashkent State Transport University

Deputy Chief Editor

Miraziz M. Talipov

Doctor of Philosophy in Technical Sciences, Tashkent State Transport University

Founder of the international scientific journal “Engineer” – Tashkent State Transport University, 100167, Republic of Uzbekistan, Tashkent, Temiryo‘lchilar str., 1, office: 465, e-mail: publication@tstu.uz.

The “Engineer” publishes the most significant results of scientific and applied research carried out in universities of transport profile, as well as other higher educational institutions, research institutes, and centers of the Republic of Uzbekistan and foreign countries.

The journal is published 4 times a year and contains publications in the following main areas:

- Engineering;
- General Engineering;
- Aerospace Engineering;
- Automotive Engineering;
- Civil and Structural Engineering;
- Computational Mechanics;
- Control and Systems Engineering;
- Electrical and Electronic Engineering;
- Industrial and Manufacturing Engineering;
- Mechanical Engineering;
- Mechanics of Materials;
- Safety, Risk, Reliability and Quality;
- Media Technology;
- Building and Construction;
- Architecture.

Tashkent State Transport University had the opportunity to publish the international scientific journal “Engineer” based on the **Certificate No. 1183** of the Information and Mass Communications Agency under the Administration of the President of the Republic of Uzbekistan. **E-ISSN: 3030-3893, ISSN: 3060-5172.** Articles in the journal are published in English language.

3	
engineer.tstu.uz	A bridge between science and innovation

Development and localization of a manufacturing technology for cast center plates for 1520 mm gauge freight wagons

Y.Y. Abdukhalikov¹, T.T. Urazbaev²^a, B.A. Abdunazarov³, O.Kh. Achildiev³

¹State Institution “Center for Improving the Efficiency of Projects and Procurement” under the Agency for Industrial Cooperation and Public Procurement, Tashkent, Uzbekistan

²Tashkent State Transport University, Tashkent, Uzbekistan

³JSC “Foundry and Mechanical Plant”, Tashkent, Uzbekistan

Abstract:

The present study addresses the scientific and engineering problem of developing and localizing a manufacturing technology for cast center plates for freight railway wagons operating on 1520 mm gauge railways, based on the production facilities of JSC “Foundry and Mechanical Plant” (Tashkent). The relevance of the research is determined by the need to establish local manufacturing of safety-critical freight wagon components using the available production equipment and commercially available grades of cast steel while ensuring compliance with the requirements of the applicable regulatory and technical documentation. According to GOST 34468-2018, the manufacture of cast center plates and center-plate seats is specified using steel grades 20FL, 20G1FL, 20GL, 20L, and 25L in accordance with GOST 977. For steel grade 25L, the carbon content shall not exceed 0.25%. The mechanical properties of cast center plates shall comply with the requirements of GOST 977. For cast center plates manufactured from the specified steel grades, the bearing and thrust surfaces shall have a hardness of at least 143 HB. In the present study, steel grades 20L and 25L are considered as the primary materials for localized production. These grades are characterized by lower cost compared with 20FL, 20G1FL, and 20GL, provided that the finished components meet the requirements of GOST 34468-2018 and GOST 977. The selection of a casting process is обусловлен by the absence of dedicated forging or stamping facilities for center plate production at JSC “Foundry and Mechanical Plant” and by the availability of an operating foundry capable of manufacturing center plates in sand-clay moulds. The technological capabilities of the plant include a 6-ton-capacity induction furnace manufactured by Otto Junker, an automatic moulding line manufactured by Kunkel Wagner, a normalizing furnace manufactured by JSC “Kerammash,” laboratory equipment for quality control of the metal and finished castings, as well as metal-cutting equipment for subsequent machining operations. The objective of the study is to develop and provide a scientific and engineering justification for a localized manufacturing technology for cast center plates made of steel grades 20L and 25L using the existing production facilities of JSC “Foundry and Mechanical Plant” while ensuring compliance with the requirements of GOST 34468-2018. Particular attention is paid to the selection of the appropriate steel grade, optimization of the gating and feeding system, ensuring adequate mould filling and controlled solidification of the casting, minimizing the risk of casting defects, development of appropriate heat-treatment parameters, and experimental verification of the manufactured components against the applicable regulatory requirements.

Keywords:

center plate, freight railway wagon, 1520 mm gauge, production localization, 20L steel, 25L steel, casting, sand-clay mould, induction furnace, gating and feeding system, heat treatment, mechanical properties, GOST 34468-2018

1. Introduction

Railway transport is one of the key components of the transport infrastructure supporting large-scale freight transportation. The reliability and operational safety of the freight wagon fleet largely depend on the quality and service reliability of critical components subjected to significant static and dynamic loads. [3]

One of the critical components of a freight wagon's central support assembly is the center plate. This component provides interaction between the wagon body and the bogie, transfers operational loads, and enables mutual rotation of

the running-gear elements as the wagon moves through curved sections of track. [4]

For freight wagons operating on 1520 mm gauge railways, the technical requirements for center plates are regulated by GOST 34468-2018, “Center Plates for Freight Wagons of 1520 mm Gauge Railways. General Technical Conditions.” The standard specifies requirements for the design, materials, manufacturing quality, acceptance, and inspection methods for center plates and center-plate seats. [1]

An important task in modern railway vehicle manufacturing and wagon repair is to reduce dependence on external supplies of critical spare parts and to establish local manufacturing technologies. For the Republic of

 <https://orcid.org/0009-0006-1808-489X>



Uzbekistan, this task is particularly important in developing an independent production base to support the maintenance and operation of the freight wagon fleet for 1520 mm gauge railways.

This study examines the feasibility of localizing center-plate production at JSC “Foundry and Mechanical Plant” in Tashkent. The enterprise has an operating foundry equipped with modern melting, moulding, heat-treatment, laboratory, and metal-cutting equipment. The existing production base provides the prerequisites for mastering center-plate manufacturing without establishing a separate stamping facility.

A major factor in selecting the manufacturing technology is the absence of stamping equipment required for producing forged or stamped center plates at the enterprise. At the same time, the plant has the technological capability to produce steel castings in sand-clay moulds. Therefore, a cast design of the center plate is proposed for production localization.

The choice of the casting technology is determined not only by the availability of appropriate equipment but also by the requirements of the regulatory documentation. GOST 34468-2018 permits the manufacture of cast center plates and center-plate seats from steel grades 20FL, 20G1FL, 20GL, 20L, and 25L in accordance with GOST 977. Thus, the casting method is normatively permissible, provided that the specified requirements for material, mechanical properties, hardness, geometry, and component quality are satisfied. [1]

Of particular interest is the possibility of using the relatively inexpensive cast-steel grades 20L and 25L instead of 20FL, 20G1FL, and 20GL. From the standpoint of production localization, the use of 20L and 25L may reduce the cost of the metallic charge and the finished component; however, the economic advantage must be considered together with compliance with the regulatory requirements for the quality and operational performance of the center plate.

The use of 25L steel requires particular control of its chemical composition, since GOST 34468-2018 limits the carbon content of this grade to no more than 0.25%. The mechanical properties of cast center plates shall comply with GOST 977. [2]

Accordingly, the main scientific and engineering problem is not merely the selection of a less expensive steel grade, but also establishing whether a cast center plate made of 20L and 25L steels can be produced that satisfies the requirements of GOST 34468-2018 using the existing equipment of JSC “Foundry and Mechanical Plant”.

A 6-ton-capacity Otto Junker induction furnace is proposed for melting. Moulding is to be performed on an automatic Kunkel Wagner moulding line using sand-clay moulds. After casting, normalization is proposed in a furnace manufactured by JSC “Kerammash”, followed by machining using the plant’s existing metal-cutting equipment.

For quality assurance, the enterprise has laboratory facilities capable of analyzing the chemical composition and physical and mechanical characteristics of the metal and monitoring the quality of finished products. The availability of this equipment makes it possible to establish a complete manufacturing cycle for the center plate directly at the local production site.

An essential element in technology development is ensuring the quality of the cast metal. In the production of large steel castings, the possibility of shrinkage cavities and

porosity, gas defects, non-metallic inclusions, hot cracks, and other defects must be considered. Therefore, the technology should account for the relationship between the chemical composition of the steel, melting parameters, pouring temperature, gating and feeding system design, mould-filling conditions, and solidification behavior. [6, 7, 8]

Particular attention should be paid to optimizing the gating and feeding system of the center plate. The component geometry, massive sections, and changes in cross-section may produce thermal nodes where conditions favorable for shrinkage defects can develop. Consequently, the rational design of metal delivery and feeding should be substantiated by analytical and experimental methods. [6, 7, 8]

Computer simulation of mould filling and metal solidification is a modern tool for addressing this problem. A computational approach makes it possible, before manufacturing a pilot batch, to evaluate the temperature field, filling sequence, solidification direction, and potential zones of shrinkage-defect formation. [9, 10]

Thus, the development of a localized center-plate manufacturing technology should be based on a comprehensive investigation of the following interrelationships: [6, 8, 9]

steel grade → chemical composition → melting parameters → pouring temperature → gating and feeding system → mould filling → solidification → casting defects → heat treatment → microstructure → mechanical properties → finished-component quality.

Research Objective

The objective of the study is to develop and scientifically and technically substantiate a localized technology for manufacturing cast center plates for 1520 mm gauge freight wagons from 20L and 25L steels at JSC “Foundry and Mechanical Plant” (Tashkent), using the existing foundry, heat-treatment, laboratory, and machining equipment while ensuring compliance with GOST 34468-2018.

Research Tasks

To achieve this objective, the following tasks must be addressed:

1. Analyze the structural and regulatory requirements for center plates of 1520 mm gauge freight wagons.
2. Analyze the requirements of GOST 34468-2018 and GOST 977 for materials used in cast center plates.
3. Substantiate the feasibility of using 20L and 25L steels as the primary materials for localized production.
4. Conduct a comparative analysis of 20L, 25L, 20FL, 20G1FL, and 20GL steels in terms of cost, chemical composition, castability, and required mechanical properties.
5. Develop a technological flow for manufacturing the center plate at JSC “Foundry and Mechanical Plant”.
6. Determine rational melting parameters for 20L and 25L steels in the 6-ton Otto Junker induction furnace.
7. Develop or optimize the gating and feeding system for casting the center plate in a sand-clay mould.
8. Investigate mould filling and metal solidification.
9. Identify potential zones for shrinkage and other casting defects.
10. Develop heat-treatment schedules for the castings using the JSC “Kerammash” normalization furnace.



11. Investigate the chemical composition, microstructure, and mechanical properties of 20L and 25L steels after casting and heat treatment.

12. Determine the hardness of the bearing and thrust surfaces of the center plate.

13. Perform dimensional and non-destructive inspection of finished components.

14. Experimentally verify compliance of the manufactured center plates with GOST 34468-2018.

15. Conduct a technical and economic comparison of the localized casting technology with alternative stamped-center-plate manufacturing.

16. Determine the economic efficiency of using 20L and 25L steels under localized production conditions.

2. Research methodology

Analysis of GOST 34468-2018 Requirements for Center-Plate Materials and Manufacturing Method

GOST 34468-2018 provides for the manufacture of center plates by various methods, including cast production. For cast center plates and center-plate seats, the standard specifies steel grades 20FL, 20G1FL, 20GL, 20L, and 25L in accordance with GOST 977. For 25L steel, the carbon content shall not exceed 0.25%. The mechanical properties of cast center plates shall comply with GOST 977. Thus, the regulatory framework permits the use of 20L and 25L steels for the component under consideration. At the same time, inclusion of a steel grade in the list specified in GOST 34468-2018 does not, by itself, mean that every manufactured component automatically meets all requirements of the standard. Compliance must be confirmed by inspection and test results for the specific products. [2]

Accordingly, this study considers the use of 20L and 25L steels as the principal scientific hypothesis: with an appropriate selection of chemical composition, melting parameters, gating and feeding system, and heat treatment, 20L and 25L steels may be used to produce cast center plates complying with GOST 34468-2018 while reducing the material component of production cost.

Rationale for Selecting the Casting Technology

The selection of the casting technology for manufacturing the center plate is determined by a combination of technical and economic factors. [4, 5]

JSC “Foundry and Mechanical Plant” has an operating foundry comprising:

- a 6-ton Otto Junker induction furnace;
- an automatic Kunkel Wagner moulding line;
- equipment for producing and preparing sand-clay moulds;
- a normalization furnace manufactured by JSC “Kerammash”;
- laboratory equipment for metal quality control;
- metal-cutting equipment for machining castings.

Thus, implementation of the casting technology does not require the establishment of a fundamentally new production unit.

The proposed technological sequence is as follows: preparation of charge materials → charge loading → melting in the induction furnace → chemical-composition control → composition adjustment → temperature control → metal tapping → preparation of the sand-clay mould → mould assembly → pouring → solidification → shakeout → casting

cleaning → visual and instrumental inspection → normalization → machining → final center-plate inspection.

The use of the automatic Kunkel Wagner moulding line makes it possible to ensure stable mould geometry and reproducibility of moulding parameters. The existing 6-ton Otto Junker induction furnace enables industrial melting of steel for pilot and subsequent serial production of center plates. The availability of the JSC “Kerammash” normalization furnace allows heat treatment to be incorporated into a single localized production cycle.

Rationale for Selecting 20L and 25L Steels

The main focus of the study is to assess the feasibility of using 20L and 25L steels instead of the more expensive grades 20FL, 20G1FL, and 20GL. [4, 6]

In accordance with GOST 34468-2018, all of the listed grades are specified for the manufacture of cast center plates. Therefore, the comparison should be based on a combination of operational and economic indicators.

The economic advantage of 20L and 25L steels should not be assessed solely by the cost per tonne of steel, but by the final cost of the center plate:

$$C_{cp} = C_{met} + C_{melt} + C_{mould} + C_{heat} + C_{mach} + C_{ins} + C_{ovh},$$

where C_{cp} is the cost of the finished center plate; C_{met} is the cost of the metallic charge; C_{melt} is melting cost; C_{mould} is moulding cost; C_{heat} is heat-treatment cost; C_{mach} is machining cost; C_{ins} is inspection cost; and C_{ovh} is overhead cost.

This approach will make it possible to quantify the economic effect of production localization.

Production Facilities of JSC “Foundry and Mechanical Plant”

The study uses the existing production infrastructure of JSC “Foundry and Mechanical Plant”.

Table 1
Technological Equipment Used for Production Localization

Technological Operation	Equipment	Primary Purpose
Melting	Otto Junker induction furnace, 6 t	Steel melting
Moulding	Kunkel Wagner automatic moulding line	Production of sand-clay moulds
Heat treatment	JSC “Kerammash” normalization furnace	Normalization of castings
Inspection	Laboratory equipment	Chemical composition and properties
Machining	Metal-cutting machines	Achieving final dimensions
Non-destructive testing	To be specified	Inspection of internal/surface defects

Thus, the proposed process assumes maximum utilization of the plant’s existing equipment.

This is one of the key principles of localization: the technology is developed not by establishing an entirely new production facility, but by adapting the existing technological infrastructure to manufacture a new safety-critical component.



Materials and Methods

The study involves two principal steel grades—20L and 25L. At the first stage, the chemical composition of each heat is determined. For 25L steel, particular attention must be paid to carbon content because GOST 34468-2018 limits it to no more than 0.25%.

The analysis should include carbon, silicon, manganese, sulfur, phosphorus, chromium, nickel, copper, and other elements in accordance with the applicable requirements for the selected steel grade. [2]

After obtaining pilot castings, the following characteristics are to be investigated: chemical composition, mechanical properties, hardness, microstructure, geometric parameters, surface quality, internal defects, and the results of heat treatment.

Proposed Experimental Research Methodology

The study should be conducted according to the following sequence.

Stage 1. Investigation of the Existing Technology

The following parameters are determined:

- casting mass;
- mass of gating elements;
- mass of risers;
- yield of sound castings;
- pouring temperature;
- chemical composition;
- moulding parameters;
- existing gating-system design;
- type and quantity of rejected castings.

Stage 2. Simulation

The following are calculated:

- mould filling;
- temperature field;
- solidification time;
- solidification direction;
- potential shrinkage zones;
- probability of porosity formation.

Stage 3. Optimization

Based on the simulation results, the following parameters are adjusted: [9, 10]

- gating-channel dimensions;
- number of feeders;
- riser locations;
- metal-entry locations;
- dimensions of system elements.

Stage 4. Manufacture of Pilot Castings

Pilot center plates are manufactured from 20L and 25L steels.

Stage 5. Heat Treatment

The castings are subjected to normalization using the JSC “Kerammash” furnace.

Stage 6. Property Characterization

The following properties are determined:

- ultimate tensile strength;
- yield strength;
- elongation;
- reduction of area;
- impact toughness;
- hardness;
- microstructure.

Stage 7. Finished-Component Inspection

The following inspections are performed:

- dimensional inspection;
- visual inspection;
- surface inspection;
- non-destructive testing;
- inspection of working surfaces.

Stage 8. Comparison with GOST Requirements

The obtained results are compared with the regulatory requirements of GOST 34468-2018 and GOST 977. [1, 2]

Scientific Hypothesis

The scientific hypothesis of this study is that the use of 20L and 25L steels in combination with an optimized casting technology using sand-clay moulds, a rational gating and feeding system, and normalization will make it possible to produce a center plate for a 1520 mm gauge freight wagon that complies with GOST 34468-2018. At the same time, the use of the less expensive 20L and 25L grades compared with 20FL, 20G1FL, and 20GL is expected to reduce the material component of the product cost. This hypothesis requires experimental verification based on a comprehensive set of indicators: [6, 7]

$$H_0: \begin{cases} C \leq C_{\text{ГОСТ}}, \\ \sigma_B \geq [\sigma_B], \\ \sigma_T \geq [\sigma_T], \\ \delta \geq [\delta], \\ KCU \geq [KCU], \\ HB \geq 143, \\ D_{\text{факт}} \leq D_{\text{доп}}. \end{cases}$$

where the normative values of mechanical properties and geometric tolerances shall be determined from the relevant sections of GOST 34468-2018 and GOST 977 for the specific center-plate design.

Expected Scientific Novelty

The expected scientific novelty of the study consists in:

1. establishing rational parameters for manufacturing center plates from 20L and 25L steels in sand-clay moulds;
2. determining the relationship between gating and feeding system parameters and defect formation in the cast preform;
3. determining the effect of melting and heat-treatment parameters on the structure and mechanical properties of the center-plate metal; [4, 5]
4. experimentally confirming the feasibility of producing a center plate from 20L and/or 25L steel that complies with GOST 34468-2018;
5. developing a technological basis for localized center-plate production using the existing production facilities of JSC “Foundry and Mechanical Plant”. [4, 5]

Practical Significance

The practical significance of the study lies in establishing a technological basis for organizing the production of cast center plates for 1520 mm gauge freight wagons in the Republic of Uzbekistan.

The use of the existing equipment of JSC “Foundry and Mechanical Plant” minimizes the need for capital investment in a new production complex.

The technology based on the available:

- 6-ton Otto Junker induction furnace; [4, 5]
- automatic Kunkel Wagner moulding line;
- JSC “Kerammash” normalization furnace;



- laboratory facilities;
- metal-cutting equipment

makes it possible to organize the complete technological cycle for manufacturing the component at a single production site.

The expected economic effect may be achieved through:

- use of more readily available steel grades;
- use of existing foundry equipment;
- elimination of the need to establish stamping production;
- reduction of external supplies;
- reduction of transportation costs;
- shorter delivery times;
- organization of serial production.

3. Conclusion

The study addresses the scientific and engineering problem of localizing the production of center plates for 1520 mm gauge freight wagons at JSC "Foundry and Mechanical Plant" in Tashkent.

The principal technological solution considered is the manufacture of the center plate by casting in a sand-clay mould, followed by normalization and machining.

The choice of the casting method is determined by the availability of the required production facilities at the enterprise and the absence of stamping production. At the same time, cast center plates are provided for by GOST 34468-2018, which allows this method to be considered normatively permissible when the specified requirements for the finished component are met. [1]

20L and 25L steels were selected as the principal materials for the study. Their use for manufacturing cast center plates is provided for by GOST 34468-2018. For 25L steel, particular attention must be paid to compliance with the carbon-content limit of no more than 0.25%. [1, 2]

The proposed technology is oriented toward maximum utilization of the plant's existing equipment: the 6-ton Otto Junker induction furnace, the automatic Kunkel Wagner moulding line, the JSC "Kerammash" normalization furnace, laboratory equipment, and metal-cutting machines.

The main direction of further research is experimental verification of the feasibility of producing high-quality cast center plates from 20L and 25L steels that comply with GOST 34468-2018, as well as determination of their production cost-effectiveness. [6, 7, 11]

A final assessment of the proposed technology should be based on a comparative analysis of the chemical composition, mechanical properties, hardness, microstructure, dimensional accuracy, surface quality, internal defects, and cost of the manufactured components. [6, 11]

References

- [1] GOST 34468-2018. Center Plates for Freight Wagons of 1,520 mm Gauge Railways. General Technical Conditions.
- [2] GOST 977. Steel Castings. General Technical Conditions.
- [3] GOST 33211-2014. Freight Main-Line Railway Wagons. Strength and Dynamic Performance Requirements.

[4] Olshevskiy A., Kim C.W., Yang H., Olshevskiy A. Wear simulation for the centre plate arrangement of a freight car // Vehicle System Dynamics. 2015. Vol. 53, No. 6. P. 856–876. DOI: 10.1080/00423114.2015.1023319.

[5] Muradian L.A., Podosonov D.O. Improving TBO of freight car bogies. Geometry model of center pad wear // Science and Transport Progress. 2017. DOI: 10.15802/stp2017/92533.

[6] Makino T., Shimokawa Y., Yamamoto M. Fatigue Property and Design Criterion of Cast Steel for Railway Bogie Frames // Materials Transactions. 2019. Vol. 60, No. 6. P. 950–958. DOI: 10.2320/matertrans.Z-M2019814.

[7] Yu L.Y., Zhao Y.X. Fatigue Limit Measurement of the Cast Steel for Chinese Railway Rolling Wagon Bogie Frames // Advanced Materials Research. 2010. Vols. 118–120. P. 121–125. DOI: 10.4028/www.scientific.net/AMR.118-120.121.

[8] Campbell J. Complete Casting Handbook: Metal Casting Processes, Metallurgy, Techniques and Design. 2nd ed. Oxford: Butterworth-Heinemann, 2015. 1054 p. ISBN 978-0-444-63509-9. DOI: 10.1016/C2014-0-01548-1.

[9] Campbell J. Casting Practice: Guidelines for Effective Production of Reliable Castings // ASM Handbook. Vol. 15: Casting. ASM International, 2008. P. 497–505. DOI: 10.31399/asm.hb.v15.a0005277.

[10] DasGupta R. Common Defects in Various Casting Processes // ASM Handbook. Vol. 15: Casting. ASM International, 2008. P. 1192–1202. DOI: 10.31399/asm.hb.v15.a0005344.

[11] Poweleit D. Selection and Evaluation of Steel Castings // ASM Handbook. Vol. 15: Casting. ASM International, 2008. P. 975–986. DOI: 10.31399/asm.hb.v15.a0005330.

[12] Shape Casting of Steel // ASM Handbook. Vol. 15: Casting. ASM International, 2008. P. 926–948. DOI: 10.31399/asm.hb.v15.a0005299.

Information about the author

**Yerdaulet
Abdukhalikov**

Lead Specialist, State Institution "Center for Improving the Efficiency of Projects and Procurement" under the Agency for Industrial Cooperation and Public Procurement
E-mail: ye.abdualikov@expertcenter.uz
Tel.: +998998410859

Talgat Urazbaev

Associate Professor, Department of Materials Science and Mechanical Engineering, Tashkent State Transport University, PhD
E-mail: talgat_1988.26@mail.ru
Tel.: +998974301088
<https://orcid.org/0009-0006-1808-489X>

**Bakhtiyor
Abdunazarov**

Head of the Foundry Complex, JSC "Foundry and Mechanical Plant"



E-mail: baxa_863@mail.ru
Tel.: +998 91 166 23 34

[o.a. surxon@mail.ru](mailto:o.a_surxon@mail.ru)
Tel.: +998 77 371 40 49

Odil Achildiev

Chief Metallurgist, JSC
“Foundry and Mechanical
Plant”
E-mail:



O. Berdiev, O. Zafarov, E. Urishbaev*Complex chemical admixture intended for improving the properties of concrete mixture.....168***I. Kavaliova, A. Panov, E. Romashova,****U. Ziyamukhamedova, L. Marchenko, Y. Podgornaya,****V. Podgornaya***A risk-oriented approach to the development of transport systems with embedded information technologies.....175***Y. Abdukhalikov, T. Urazbaev, B. Abdunazarov,****O. Achildiev***Development and localization of a manufacturing technology for cast center plates for 1520 mm gauge freight wagons.....180***A. Urakov, E. Ashurov***Study of the impact of heavy trucks on the smoothness of asphalt concrete pavement.....186*