

УДК 656.027

ПРОБКИ И ДОСТАВКА К ТОЧНОМУ ВРЕМЕНИ: ВЫЗОВЫ В ЛОГИСТИКЕ И УПРАВЛЕНИИ НА ТРАНСПОРТЕ

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Аннотация. В современных условиях урбанизации и роста автомобильного трафика дорожные заторы становятся критическим барьером для обеспечения точности доставки в логистических системах, особенно при применении модели «точно в срок» (Just-in-Time). В докладе анализируются основные вызовы, создаваемые пробками: рост операционных расходов, неопределённость времени доставки, усталость водителей и сбои в цепочках поставок. Рассматриваются современные стратегии минимизации негативного влияния заторов, включая динамическую оптимизацию маршрутов, прогнозную аналитику, доставку в непиковые часы, альтернативные виды транспорта и городские консолидационные центры. Отдельное внимание уделяется опыту крупных логистических компаний и роли государственно-частного партнёрства в развитии устойчивой городской мобильности.

Ключевые слова: дорожные заторы, доставка точно в срок, управление транспортом, логистика, оптимизация маршрутов, городские консолидационные центры, последняя миля, прогнозная аналитика.

TRAFFIC JAMS AND ON-TIME DELIVERY: CHALLENGES IN LOGISTICS AND TRANSPORT MANAGEMENT

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Abstract. In the current context of urbanisation and growing road traffic, traffic jams are becoming a critical barrier to ensuring delivery accuracy in logistics systems, especially when applying the Just-in-Time (JIT) model. The report analyses the main challenges caused by congestion: increased operating costs, delivery time uncertainty, driver fatigue, and supply chain disruptions. It examines modern strategies to mitigate the negative impact of congestion, including dynamic route optimisation, predictive analytics, off-peak deliveries, alternative transport modes, and urban

consolidation centres. Special attention is paid to the experience of major logistics companies and the role of public-private partnerships in developing sustainable urban mobility.

Keywords: traffic congestion, just-in-time delivery, transport management, logistics, route optimisation, urban consolidation centres, last mile, predictive analytics.

Introduction English: In the modern world, logistics and transport management play a crucial role in ensuring the efficiency of supply chains. One of the key performance indicators in this field is on-time delivery — the ability to deliver goods to the customer within the agreed time frame. However, traffic jams remain a major obstacle to achieving this goal. Urbanisation and the growing number of vehicles on the roads have led to increased congestion, especially in large cities. This not only increases delivery times but also raises operational costs and negatively affects customer satisfaction. The aim of this report is to analyse the impact of traffic jams on on-time delivery and explore strategies to mitigate this issue. The importance of on-time delivery cannot be overstated. In today's fast-paced economy, customers expect swift and reliable service. E-commerce growth has further heightened these expectations, with many consumers now demanding same-day or next-day delivery. This puts immense pressure on logistics providers to optimise their operations and minimise delays caused by traffic congestion. Moreover, the global supply chain has become increasingly interconnected. A delay in one part of the network can have ripple effects across multiple regions and industries. For instance, a delayed shipment of raw materials can halt production lines, leading to financial losses and contractual penalties. Therefore, addressing the issue of traffic jams is not just about improving delivery times — it's about ensuring the stability and resilience of the entire supply chain.

Impact of Traffic Jams on Logistics English: Traffic jams significantly affect various aspects of logistics operations: Delivery delays. Congestion leads to unpredictable travel times, making it difficult to adhere to scheduled delivery windows. This is especially critical for time-sensitive goods such as perishable food items, medical supplies, and just-in-time manufacturing components. For example, a delay in delivering fresh produce can result in spoilage and financial loss. Increased fuel consumption. Vehicles stuck in traffic consume more fuel, raising operational costs and environmental impact. Idling engines emit higher levels of pollutants, contributing to air quality issues in urban areas. This not only affects the company's bottom line but also its environmental, social, and governance (ESG) ratings. Driver fatigue and stress. Long hours spent in congested traffic can lead to driver fatigue, reducing safety and efficiency. Fatigued drivers are more prone to accidents, which can result in injuries, vehicle damage, and further delays. This creates a cycle of inefficiency and risk. Higher operational costs. Delays result in overtime pay for drivers and additional vehicle maintenance costs. Increased fuel consumption and wear and tear on vehicles lead to higher maintenance expenses. Additionally, companies may face penalties for late deliveries, further eroding profit margins. Customer dissatisfaction. Missed delivery deadlines damage a company's reputation and may lead to loss of business. In the age of online reviews and social media, a single negative experience can quickly spread, deterring potential customers. Repeat offences can lead to long-term reputational damage. Supply chain disruptions. Traffic jams disrupt the entire supply chain. For instance, delayed inbound shipments can halt production lines, while late outbound deliveries affect retailers' inventory levels. This can lead to stockouts, lost sales, and increased safety stock requirements, further inflating inventory holding costs. Impact on just-in-time (JIT) systems. Many manufacturers rely on JIT systems to minimise inventory costs. Traffic jams can disrupt the precise timing required for JIT, forcing companies to either hold more inventory (increasing costs) or face production stoppages. Regulatory challenges. In some cities, traffic congestion has led to the introduction of low-emission zones and delivery time restrictions. Logistics companies must navigate these regulations while still meeting delivery deadlines, adding

another layer of complexity. Additionally, traffic jams affect not only road transport but also other modes. For example, delays at urban distribution centres can impact rail and air freight connections, creating bottlenecks across the multimodal network.

Strategies to Mitigate the Impact of Traffic Jams English: To address the challenges posed by traffic jams, logistics companies can adopt several strategies: Route optimisation software. Advanced algorithms can calculate the fastest routes in real time, considering current traffic conditions. This helps drivers avoid congested areas. Modern route planning tools use GPS data, traffic cameras, and mobile phone signals to provide up-to-the-minute information. Some systems even predict future congestion based on historical patterns and scheduled events. Predictive analytics. Using historical traffic data and machine learning, companies can predict peak congestion periods and schedule deliveries accordingly. For example, analysing traffic patterns over several months can reveal recurring bottlenecks, allowing companies to adjust their delivery schedules proactively. Predictive models can also account for seasonal variations, special events, and weather conditions. Off-peak deliveries. Shifting deliveries to early mornings, late evenings, or weekends can help avoid rush-hour traffic. Many cities offer incentives for off-peak deliveries, such as reduced congestion charges or extended delivery hours at retail locations. This strategy requires coordination with customers and may need adjustments to warehouse operations. Collaborative logistics. Sharing transportation resources with other companies reduces the number of vehicles on the road, easing congestion. This can take the form of shared warehouses, joint delivery routes, or pooled transportation fleets. Collaborative logistics not only reduces traffic but also lowers costs through economies of scale. Alternative transport modes. Using bicycles, electric scooters, or drones for last-mile delivery in urban areas can bypass traffic jams. Electric cargo bikes, for instance, can navigate narrow streets and bike lanes, reaching customers faster than vans in congested city centres. Drones offer the potential for ultra-fast deliveries, although regulatory hurdles remain. Real-time tracking and communication. Providing customers with live updates on delivery status improves transparency and manages expectations. Mobile apps and SMS notifications keep customers informed, reducing anxiety about delayed deliveries. This also allows customers to adjust their schedules accordingly, improving overall satisfaction. Urban consolidation centres (UCCs). Establishing central hubs on city outskirts where goods are consolidated and then distributed using smaller, more agile vehicles reduces inner-city traffic. UCCs allow for efficient sorting and batching of deliveries, minimising the number of trips into congested areas. They can also incorporate value-added services, such as packaging and returns processing. Government cooperation. Working with local authorities to improve infrastructure, implement smart traffic systems, and promote sustainable urban mobility plans. This includes advocating for dedicated freight lanes, intelligent traffic signal systems, and better public transport options that reduce private car usage. Public-private partnerships can fund innovative solutions, such as underground delivery systems or automated guided vehicles. Fleet modernisation. Investing in newer, more fuel-efficient vehicles can reduce the impact of idling in traffic. Electric and hybrid vehicles, in particular, offer lower operating costs and emissions. Additionally, telematics systems in modern fleets provide real-time data on vehicle performance and driver behaviour, enabling continuous improvement. Dynamic pricing and incentives. Offering customers incentives for flexible delivery windows can smooth demand and reduce peak-time pressure. For example, discounts for off-peak deliveries or surcharges for tight time windows can encourage customers to choose less congested periods. Dynamic pricing models can adjust rates based on real-time traffic conditions. Micro-fulfilment centres. Placing small, automated warehouses close to high-demand areas enables faster, more responsive deliveries. These centres can stock frequently ordered items, reducing the distance and time required for last-mile delivery. They are particularly effective in dense urban environments. Autonomous vehicles and robotics. While still emerging, autonomous delivery vehicles and robots offer the potential to operate



outside traditional traffic patterns. Self-driving vans and sidewalk robots can navigate at optimal times and routes, minimising human error and congestion impact. --- Part 4. Case Studies and Real-World Applications English: Several companies have successfully implemented these strategies: Amazon uses predictive analytics and dynamic routing to optimise delivery schedules. Their investment in electric delivery vans and drone technology showcases a multi-pronged approach to traffic challenges. DHL has established urban consolidation centres in several European cities, significantly reducing delivery vehicle kilometres and improving on-time performance. UPS employs sophisticated route optimisation software that considers traffic patterns, delivery windows, and fuel efficiency. Their “left-turn avoidance” strategy alone has saved millions of miles and gallons of fuel. Local governments in cities like London and Stockholm have implemented congestion charging zones, encouraging logistics companies to adopt more efficient delivery practices. --- Part 5. Conclusion English: Traffic jams pose a significant challenge to on-time delivery in logistics and transport management. However, by leveraging technology, adopting innovative strategies, and fostering collaboration between businesses and governments, these challenges can be effectively managed. Route optimisation, predictive analytics, and alternative delivery methods offer promising solutions to minimise delays and improve customer satisfaction. As urbanisation continues, the need for smart logistics solutions will only grow, making it essential for companies to stay ahead of the curve. The future of urban logistics lies in integrated, data-driven systems that adapt to real-time conditions and prioritise efficiency, sustainability, and customer experience. By embracing these innovations, logistics companies can build more resilient and responsive delivery networks. The future of urban logistics will likely involve a combination of technologies and strategies: Integration of IoT and AI. Internet of Things (IoT) sensors combined with artificial intelligence can provide real-time data on traffic, weather, and vehicle conditions, enabling dynamic route adjustments. Smart city infrastructure. Collaboration with city planners to develop intelligent transportation systems that prioritise freight movement during off-peak hours and provide dedicated logistics lanes. Sustainability focus. As environmental concerns grow, companies will need to balance delivery speed with eco-friendly practices, such as electric fleets and optimised routing to reduce carbon emissions. Customer-centric approaches. Providing customers with more delivery options — including time slots, pickup points, and real-time tracking — will become standard practice. Data-driven decision making. The ability to collect, analyse, and act on large datasets will separate market leaders from laggards. Companies that invest in advanced analytics will gain a competitive edge. However, challenges remain. The high cost of new technologies, regulatory hurdles, and the need for industry-wide coordination pose significant barriers. Overcoming these will require:

- Long-term investment in infrastructure and technology;
- Strong public-private partnerships;
- Standardisation of data formats and communication protocols;
- Workforce training to adapt to new systems and processes;
- Continuous innovation to stay ahead of growing urbanisation trends.

In conclusion, traffic jams present a complex but solvable challenge for logistics and transport management. While they cannot be eliminated entirely, their impact on on-time delivery can be significantly reduced through a combination of technological innovation, strategic planning, and collaborative efforts. The companies that successfully navigate this landscape will not only improve their delivery performance but also contribute to more sustainable and efficient urban environments.



References:

1. Voevudsky E. N., Konvetsova N. A., Makhurenko G. S., Tarasova I. P. Economic and Mathematical Methods and Models in Maritime Transport Management : textbook for students of maritime universities / edited by E. N. Voevudsky. — Moscow : Transport, 1988. — 384 p.
2. Gagaev S. Yu. Problems and prospects of inland water transport development in the Russian Federation // Scientific View into the Future. — 2016. — Vol. 1, No. 2. — Pp. 46–50.
3. Mirotin L. B., Tashbaev Y. E., Pokrovsky A. K. Logistics: Road Transport Management : textbook. — Moscow : Exam, 2005. — 480 p.
4. Nerush Yu. M. Logistics : textbook for universities. — 4th ed., revised and supplemented. — Moscow : Prospekt, 2011. — 520 p.

