



Digitalisation of Moscow transport

The new opportunities offered by big data analytics and machine learning are opening up bright prospects for Moscow transport in the 21st century. Moscow is at the forefront of change as it embraces the most advanced technologies and the best national and international innovations.

24^{/7}
operation of the Traffic
Management Centre's control
centre

100%
of the city covered by the Intelligent
Transport System

TRAFFIC CONTROL

An Intelligent Transport System (ITS) has been operating in Moscow since 2011. It initially covered 30% of the city, and has now reached 100%. The ITS is a comprehensive monitoring system for traffic control and public transport operation.



The amount of data generated daily by the transport system is comparable to that of a major bank's transaction volumes.

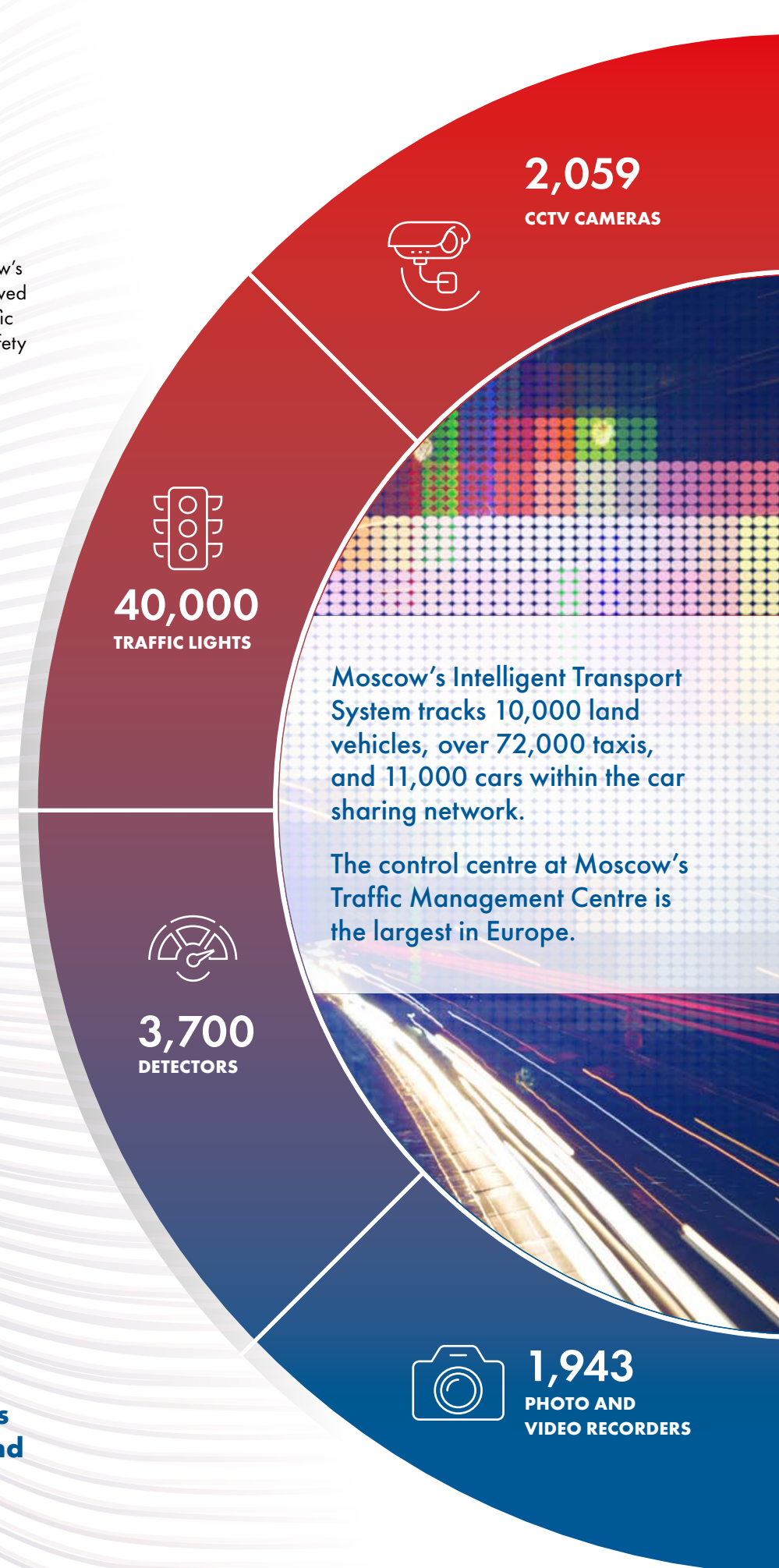
In 2013, a control centre was launched at Moscow's Traffic Management Centre to analyse data received from the equipment installed across the city – traffic speed sensors, adaptive traffic lights and road safety cameras, controlled CCTV cameras, and GPS/GLONASS sensors on public transport.

The Traffic Management Centre receives over 350 million data packages per day from various locations, including:

80 mln
trips

45 mln
speed measurements from sensors

Over 60 mln
vehicle telematics data entries in the Regional Navigation and Information System (RNIS)



Moscow's Intelligent Transport System tracks 10,000 land vehicles, over 72,000 taxis, and 11,000 cars within the car sharing network.

The control centre at Moscow's Traffic Management Centre is the largest in Europe.

-34%
reduction in road fatalities (down to 2.9 deaths per 100,000 residents) from 2010

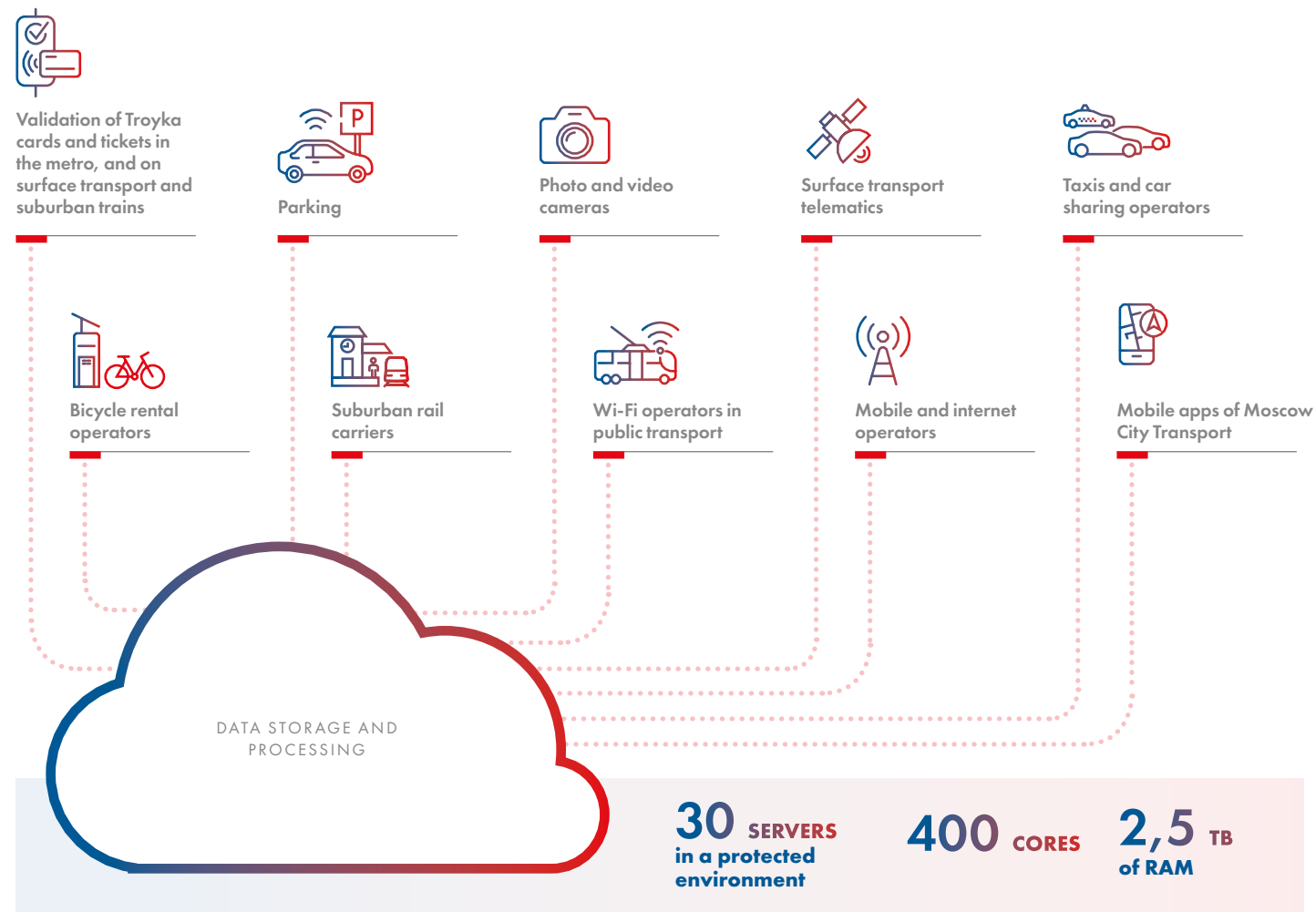
-59%
reduction in traffic accidents from 2010

+16%
increase in the average traffic speed from 2010

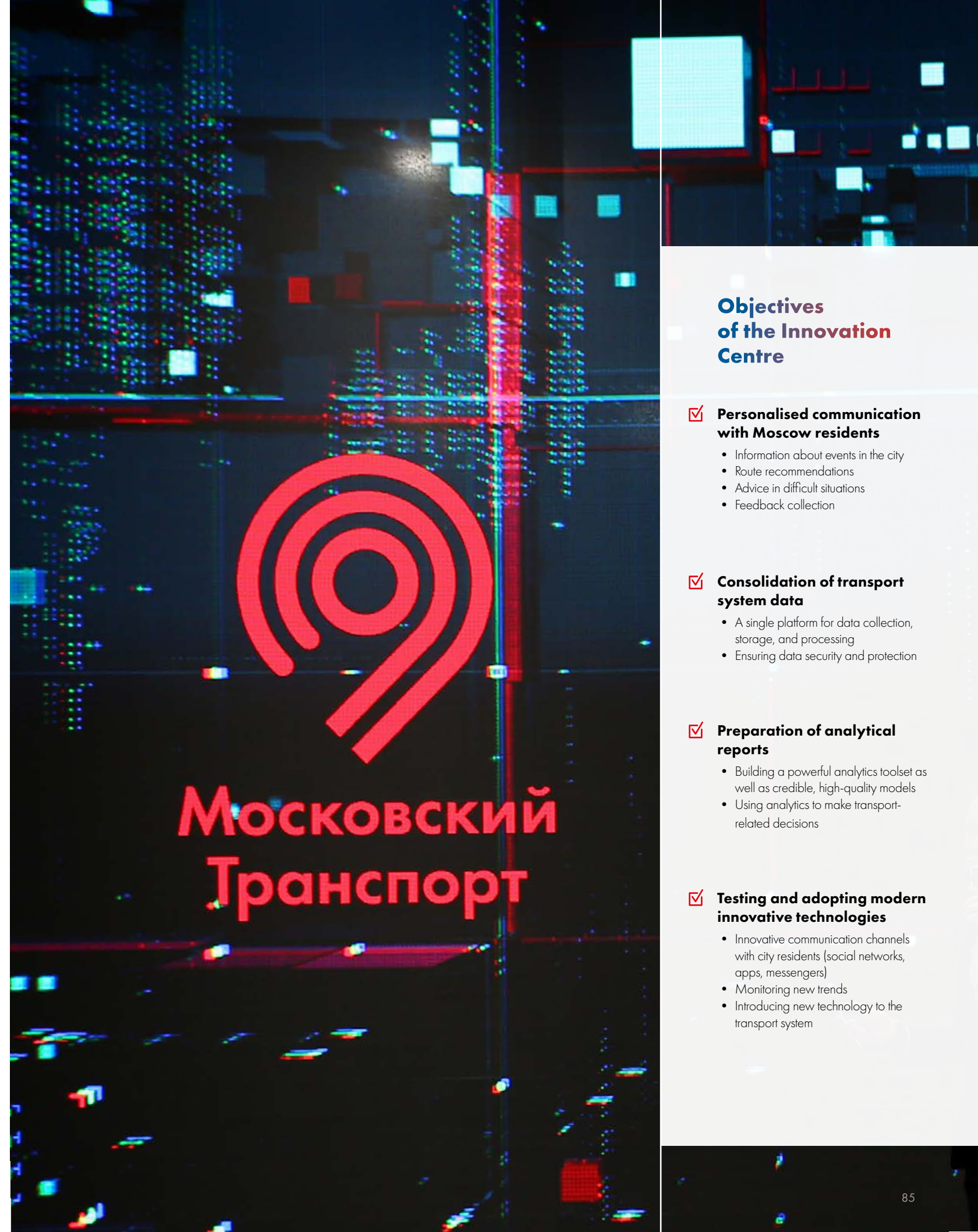
INNOVATION CENTRE

The Innovation Centre was established in 2017 to improve the quality and benefits of processing big data.

DATA SOURCES



END PRODUCTS



Objectives of the Innovation Centre

- ✓ **Personalised communication with Moscow residents**

 - Information about events in the city
 - Route recommendations
 - Advice in difficult situations
 - Feedback collection
- ✓ **Consolidation of transport system data**

 - A single platform for data collection, storage, and processing
 - Ensuring data security and protection
- ✓ **Preparation of analytical reports**

 - Building a powerful analytics toolset as well as credible, high-quality models
 - Using analytics to make transport-related decisions
- ✓ **Testing and adopting modern innovative technologies**

 - Innovative communication channels with city residents (social networks, apps, messengers)
 - Monitoring new trends
 - Introducing new technology to the transport system

COMPREHENSIVE SAFETY ON TRANSPORT

The Moscow Government's comprehensive programme ensures the safety and full-scale protection of all passengers aboard public transport.

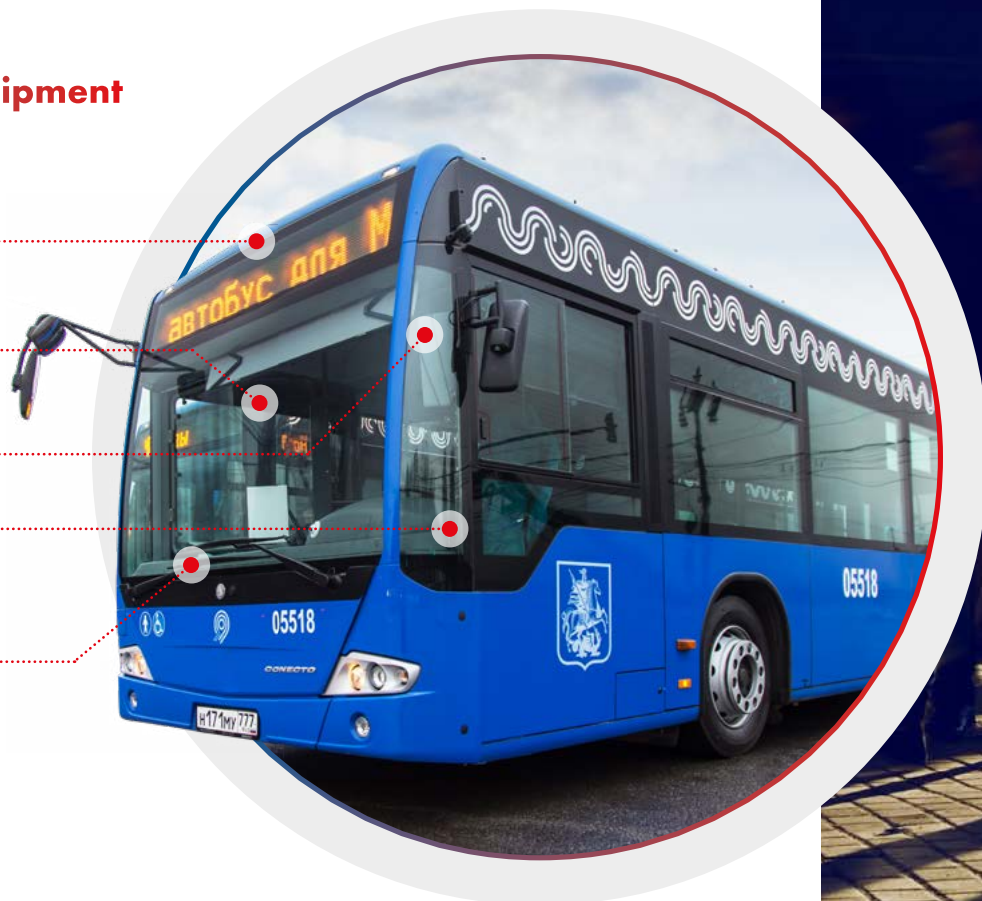
SURFACE TRANSPORT

Surface transport vehicles are consistently being equipped with modern engineering and technical equipment and systems assuring transport safety, including photo and video recording and transfer of images or streaming videos at a dispatcher's request. Vehicle locations are tracked and geo-referenced using the GLONASS system, enabling dispatchers to respond immediately to an incident and send assistance.

100% of surface transport vehicles are equipped with GPS/GLONASS systems as well as both external and onboard CCTV

Set of safety and security equipment installed in a Mosgortrans passenger vehicle

- Smoke and heat detectors
- Automated passenger traffic control sensors and controllers
- CCTV microphone
- Panic button
- Onboard NAV/COM station
- Onboard VHF NAV/COM radio
- 3G modem
- Dashcam
- Video cameras (forward facing, reversing, driver facing, and compartment cameras)
- Fuel level sensors



METRO

The Transport Safety Management Centre was opened in 2017. It receives data from all CCTV cameras in the metro and has access to the cameras on the MCC.

Currently more than 7,700 Safety Service employees are on duty at metro stations and entrances. Emergency call points are installed at all stations.

and security checkpoints with specialised equipment for detecting prohibited items and substances are set up at metro entrance halls.

A comprehensive approach adopted in 2017 enabled a 35% year-on-year decrease in the number of crimes occurring in the metro, while the number of administrative violations fell 21% year-on-year.

10x faster metro employee response times to incidents due to the new system

Over 42 mln (up 90% year-on-year) luggage items inspected in 2017

Over 250,000 (up 30% year-on-year) dangerous items detected in 2017

17,300 CCTV CAMERAS are installed in the Moscow metro

- 3,900** on trains
- 3,500** on platforms
- 1,230** on escalators

Smart CCTV system

5,700 smart CCTV cameras:

- IP cameras for situational and general surveillance
- Machine vision cameras with threat recognition functions

Cameras can identify crowding, unusual activity, disorderly behaviour, lost property, and trespassing and help the Transport Safety Management Centre dispatchers make prompt decisions. Video stream data are stored in a specifically built 11 PB data centre.



2,500 in underpasses and in adjacent areas

5,700 in entrance halls

500 in train depots, substations, and ventilation shafts

PASSENGER SERVICES

Moscow transport offers state-of-the-art passenger services on par with leading global transport systems.

Free Wi-Fi on public transport (MT_FREE)

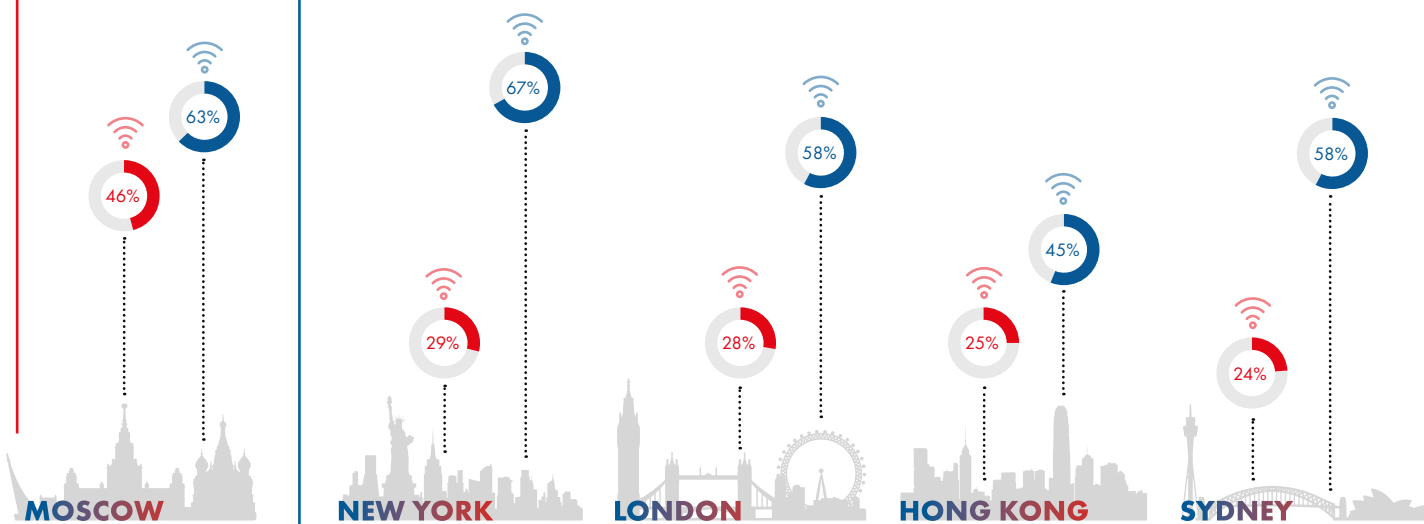
MT_FREE is Europe's largest single-login access Wi-Fi network on public transport. It covers all metro trains, surface transport rolling stock and fleets, new surface transport stops, the MCC, as well as Aeroexpress trains and terminals. Passengers can benefit from a seamless Wi-Fi experience when interchanging between different modes of transport.



- Share of passengers using Wi-Fi as their preferred connectivity option when travelling by public transport
- Share of passengers satisfied with the Wi-Fi connection quality on public transport

The public transport Wi-Fi network is more popular in Moscow than in other large cities

Moscow's public transport Wi-Fi network is one of the best globally in terms of connection speeds and user-friendliness

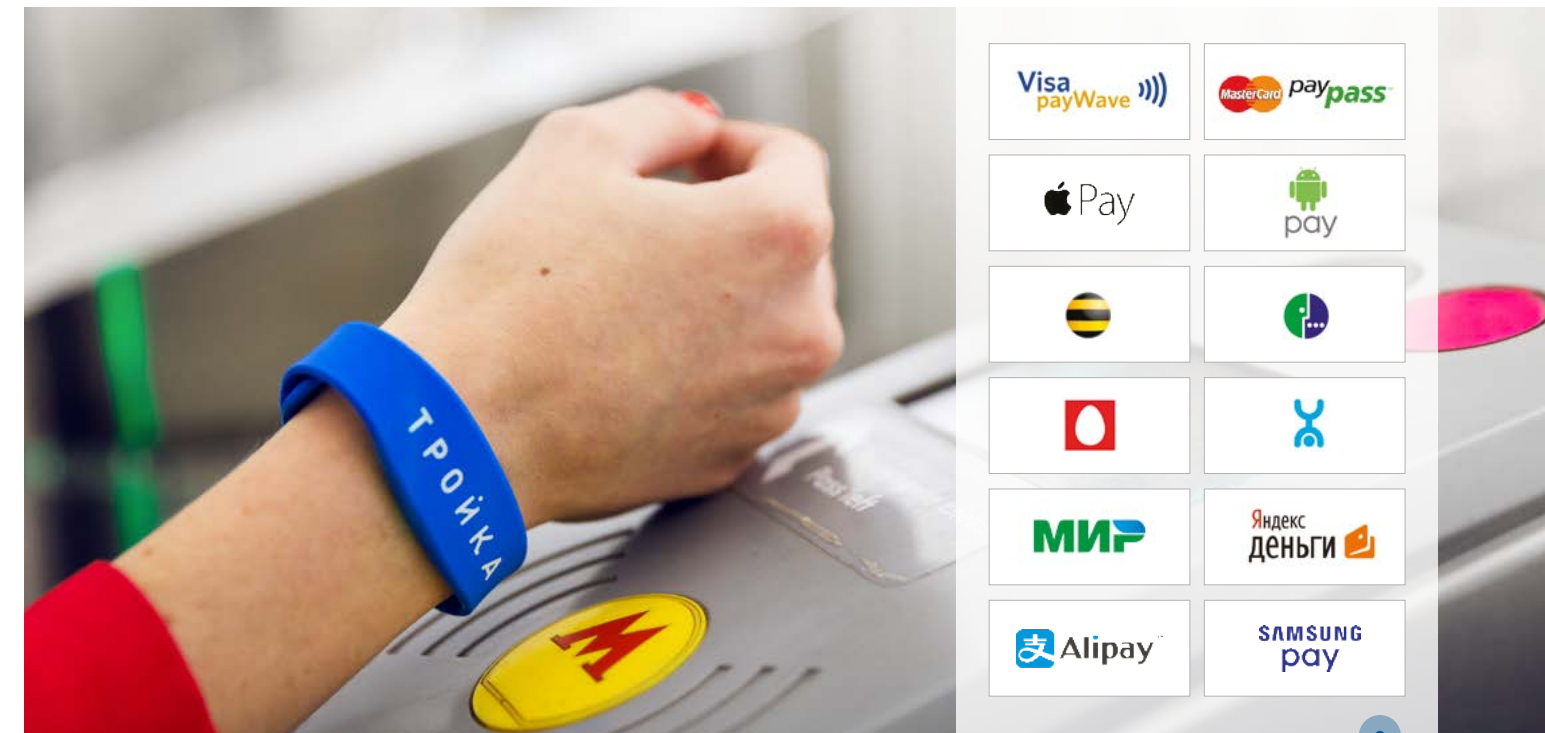


Source: Wireless Broadband Access (WiBB) for the Digital Economy study by Ernst & Young (EY).

Universal travel card: Troyka

The Troyka card can be used to travel by any mode of public transport, rent bicycles, and visit museums and ice-skating rinks around Moscow, with 88% of passengers using Troyka as their preferred fare payment method. Since June 2018, Troyka users on the Wallet plan can benefit from a loyalty programme and get bonuses and discounts in stores, pharmacies, restaurants, dry cleaners, private clinics, beauty salons, cinemas, and with other partners, as well as free travel on public transport.

The Troyka – Strelka integrated travel card allows travel on both urban and suburban transport, and the Troyka – Podorozhnik travel card is valid in both Moscow and Saint Petersburg.



Variety of payment options

Moscow Metro passengers can choose the most convenient method of payment:

- Troyka card
- Social card
- Contactless bank cards (PayPass and PayWave)
- Mobile ticketing
- Bank cards via Android Pay, Apple Pay, and Samsung Pay
- QR codes (piloted at four metro stations)

INTERACTION WITH MOSCOW RESIDENTS

An ongoing dialogue with each passenger is helping improve the performance of Moscow Transport



Moscow Transport mobile apps

- Mosgortrans**
For details, see page 110
- Velobike**
For details, see page 107
- Mosgorpass**
For details, see page 110
- Moscow Assistant (Pomoschnik Moskvy)**
For details, see page 103
- MosMetro**
For details, see page 112
- Moscow Parking**
For details, see page 119

3.5
MLN DOWNLOADS
total for all Moscow Transport mobile apps



Active Citizen

Active Citizen is a project developed on behalf of Moscow Mayor Sergei Sobyenin, launched in April 2014. Moscow residents have voted on multiple transport-related matters using a dedicated portal.

www.ag.mos.ru

Portal for Citizens



Major voting results:

- Selecting the colour pink for the new metro line under construction in 2014 and choosing its name – Nekrasovskaya in 2018
- A total 480,900 Moscow residents chose the name for the Moscow Central Circle project in a two-stage voting process in 2017
- Reducing the number of announcements on escalators in the Moscow metro
- Naming the next-gen Moskva train
- Selecting the locations for new pedestrian zones in the Zamoskvorechye District

OVER 45
transport-related topics discussed on the portal since 2014

116
transport innovations rated by Moscow residents

For contact details, see page 124



No project is implemented without collecting opinions from Moscow residents. Moscow has two service centres processing over 5,000 queries, suggestions, and requests via phone calls, emails, or personal contacts every week. We also handle all suggestions and requests submitted in social media.



Moscow Deputy Mayor for Transport
Maxim Liksutov

Moscow Transport in social media

Social media is key to maintaining a dialogue with Moscow residents, allowing them to leave opinions and ask Moscow Transport (MT) staff questions.

SOCIAL FOLLOWING¹

- @transportmos
78,185
- @DiRoad
24,000
- @mostransport
16,100
- @mostransport
12,710
- @mostrans
7,431
- @DiRoad
3,600

381
Average daily unique visitors on MT's VKontakte page

5,160
Average monthly reach of MT's Instagram post

1,343
Average monthly reach of MT's Facebook post

144
Average monthly reach of MT's Odnoklassniki post

¹ Followers across all social media as at 28 June 2018.

A PATH TO THE FUTURE

Global development outlooks for urban transport

Electrification and the environment

Electric car sales are stimulated by incentives and subsidies for car owners, such as reduced battery costs and environmental restrictions. According to the International Energy Agency (IEA), the number of electric cars doubled in 2017 to above three million worldwide. After 2020, the United States, EU, and China will introduce stricter requirements on car energy efficiency, thereby further driving sales upwards.

Shared mobility

Taxi aggregators, car sharing, and other services that increase mobility are gaining market shares across the world.

Internet of Things

Uninterrupted vehicle connectivity enables remote software updates and transmission of road traffic information to increase road safety.

Autonomous (self-driving) transport

Self-driving vehicles save time for private car owners, reduce costs, and are changing the parking laws in large cities.

GLOBAL TECHNOLOGY TRENDS

42 -FOLD
(up to 125 million vehicles)
in the number of electric cars by 2030 worldwide has been forecast by the IEA

450
MILLION USERS
make 25 million trips a day using Didi Chuxing, a Chinese taxi aggregator

75%
CAR OWNERS
support automatic data transfers to car manufacturers

Under particular urban projects, fully autonomous vehicles will be hitting the roads as early as 2020

CAR-SHARING MODELS



Car sharing is the short-term rental of cars for travel within the city



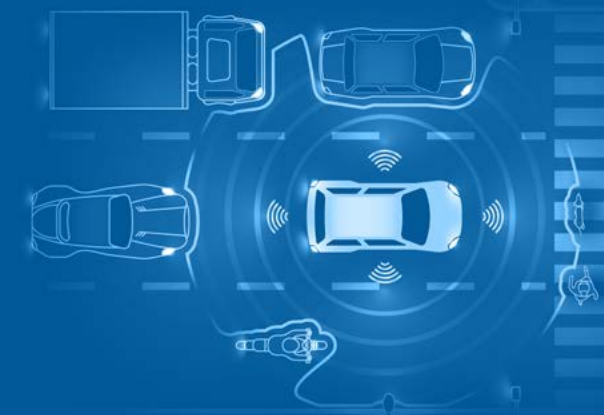
P2P car sharing is a platform for car owners to rent their cars out to other people for a short period of time



A taxi aggregator is a mobile and/or online platform for finding licensed taxis for one-off trips

HOW WILL AUTONOMOUS CARS CHANGE URBAN LIFE?

- A self-driving car can perform tasks while the owner is elsewhere, such as picking up food from a supermarket or children from school, or transporting small cargoes.
- One car can be shared by many people to minimise unproductive downtime.
- It can be parked far from home or work to reduce the use of car parks and related costs for car owners. When needed, the car will drive to the specified address on its own.
- The resulting free space around the city can subsequently be used for walking zones, bicycle paths, parks, and garden squares.



Stages of smart city evolution in transport and urban mobility

Smart mobility – a set of next generation solutions for travelling as quickly, comfortably, and safely as possible.

INITIATIVES

	Intelligent Transport System	100% coverage of the city by the Intelligent Transport System
	Electronic card Troyka	10 top-up methods
	Car parking payment system	8 car parking payment methods
	A traffic violation management system	Automatic registration of violations
	Taxi ordering	Pick-up time of up to 5-7 minutes during peak hours

	Command centre at the Traffic Management Centre	24/7 operation
	Automation of traffic and transport control	Smart traffic lights, smart CCTV cameras, 100% GPS/GLONASS coverage on surface transport
	Wi-Fi on public transport	100% of public transport vehicles covered
	Mobile apps	6 Moscow Transport mobile apps
	Public control over compliance with traffic rules	Moscow Assistant app
	Active Citizen	The voice of Moscow residents is at the heart of our decisions significant for the city's way of life
	Public bicycle rental system	System automation
	Car-sharing system	72,000 taxis 11,000 shared cars
	Passenger interfaces	Over 10 feedback channels
	Automated monitoring of transport and infrastructure condition (self-diagnostics)	Moskva metro train
	Advanced fare payment methods on public transport	Over 9 ticketing options

- Use of big data – Innovation Centre**
- Smart City 2030 digital development strategy**
- Facial recognition**
- Autonomous transport**
- Promoting car sharing**
- Process automation and robotics**

RESULTS

➤ 2011

➤ 2014

➤ 2018+

➤ Biometrics

Biometrics is a method for recognising and authenticating people based on their physiological and behavioural profiles.



MOSCOW
Metro CCTV with facial recognition

LONDON
Pilot palm vein scanning project for card readers

ISTANBUL
Fingerprint-based check-in at the airport

SHANGHAI
Voice control of ticket machines

JINAN
Facial recognition check-in when boarding a train

WHERE IS BIOMETRICS ALREADY USED ON TRANSPORT?

EXAMPLES OF USE



Fingerprinting

- Smartphone protection
- Touch and pay (Sberbank)



Palm vein pattern

- Identification of school students to pay for services
- Metro pay-gates



Face

- Identification of wanted criminals in a crowd
- Mood recognition (Amazon)



Gait and other movement patterns

- Smartphone user identification (by movement rhythm)



Retina

- ATM identification
- Next-generation passports



Speech

- Speech-to-text
- Identification through call centres



Voice

- Identification at ticket machines
- Equipment voice control



Personality

- Career guidance
- Behaviour correction