Kapsch TrafficCom

Delivering the vision of sustainable mobility

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Why urgent action is needed to reduce vehicle emissions and make transport more sustainable

In December 2015, 195 nations who are responsible for 90% greenhouse gas emissions, signed the Paris Agreement, making individual commitments to dramatically reduce their carbon emissions, with many promising to achieve carbon neutrality by 2030[1]. This concerted effort to reduce greenhouse gas emissions aims to prevent further rising of sea levels and other related climate phenomena by keeping the global increase in temperature below 1.5 degrees Celsius above pre-industrial levels[2].

The challenge for all of us is to strive to meet and exceed the climate goals outlined in the Paris agreement. However, unless the world begins to rapidly reduce greenhouse gas emissions, the goals outlined in the Paris Agreement will slip out of reach according to the latest UN Environment Programme (UNEP) emissions gap report[3].
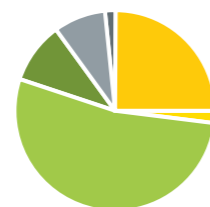
Why Transport emissions are a growing climate change and air pollution challenge

While many industries are managing to reduce their emissions year on year, transport is going the other way as the number of vehicles on road networks continues to grow. As such, transport is becoming one of the sectors that is threatening to undermine Paris Agreement targets and reduce our overall ability to keep temperatures more than 1.5 degrees Celsius below pre-industrial levels.

In total, the transport industry – which is the fastest growing source of global emissions – generates around 25% of total CO_2 released into the environment. The remaining 75% of global emissions are caused by buildings, industry etc. (see pie chart below).

As well as releasing greenhouse gases, excessive traffic is also negatively impacting air quality, with up to 91% percent of the population now living in cities where air quality is below WHO-defined safe levels, and an estimated 4.2 million air-pollution-related deaths each year[4]. With 37% road traffic is one of the main sources of the bad air quality (see pie chart below on air pollution).

Bold, immediate actions are needed to curb transport emissions

To reduce the negative environmental and public health impacts of polluting vehicles, authorities are innovating their transport strategies. In particular, green forms of transport have become a major focus for investment, from e-mobility schemes in city centres, to allocation of space on the road network for bus lanes, bike lanes, tram infrastructure, and more.

But while green transport options are ultimately key to making transport truly sustainable, shorter term solutions are urgently needed to curb emissions from millions vehicles on the world's road networks.

The sustainable mobility journey begins with joined-up traffic management

In this Kapsch TrafficCom guide, we propose an innovative way to reduce traffic demand and curb emissions based on joined-up traffic management. As well as reducing congestion and improving traffic flow on busy networks, this approach can influence drivers to moderate and modify their road-usage behaviour, freeing space on road networks for greener transport alternatives.

Climate Change
Sources of GHG Emissions

Air Pollution
Sources of $PM_{2.5}$ Concentration

- 25% Road Traffic
- 3% Other Transport
- 52% Buildings
- 9% Industry
- 8% Waste
- 2% Other
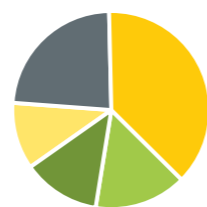
- 37% Road Traffic
- 16% Buildings
- 14% Industry
- 13% Natural Background
- 20% Other

Source: C40 cities study: Toward a healthier world

Urban traffic and congestion management provide an immediate impact on both traffic volumes and smoother traffic flow, helping to reduce CO_2 emissions. Reducing stop-and-go-traffic by communicating traffic signal information to drivers alone has been shown to reduce fuel consumption and therefore emissions according to a recent study from Canada.

More advanced methods, involving vehicle connectivity and AI-based data processing, can further reduce emissions caused by congestion and inefficient traffic.

Equally importantly, traffic and congestion management can play a key role facilitating the use of public transport.

> **Alfredo Escriba, CTO of Kapsch TrafficCom**

[1] https://www.climatechangenews.com/2019/06/14/countries-net-zero-climate-goal/
[2] https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement
[3] https://www.carbonbrief.org/unep-1-5c-climate-target-slipping-out-of-reach
[4] https://www.wri.org/blog/2019/10/everything-you-need-know-about-fastest-growing-source-global-emissions-transport

A brief history of traffic management: siloed systems and limited benefits

For decades, authorities in many countries have been implementing intelligent transport systems to reduce congestion and improve air quality – from signalling solutions to congestion charging schemes. However, legacy approaches tend to focus on stand-alone and siloed solutions that use only a tiny subset of the traffic data now available, and provide only limited emissions and air quality benefits.

Examples of siloed intelligent transport solutions with limited impact include:

1

Stand-alone signal optimisation solutions

Many cities use signalling solutions that change traffic light timings during rush hours throughout the day. However, these can only be optimised by integrating real-time traffic data, either from costly sensors at intersections, or from other sources such as vehicle data or data from road-users' smartphones. Without integrating these kinds of devices and data sources, signalling cannot fulfil its potential as a tool for reducing 'stop-start' traffic emissions.

2

Multiple, unconnected agencies and systems in the traffic management ecosystem

Effective traffic management depends on integrating the efforts of city authorities, regional and highways authorities, public transport providers, and emergency services. Today, these organisations often work in a stand-alone way, with their own aims and objectives, and their own systems and processes. This disconnect between traffic management and public transport stakeholders makes it difficult or impossible to mount a coordinated response to high traffic demand, congestion, and excessive emissions. It also presents a major challenge when it comes to sharing traffic management policies and responses with private third-parties, such as navigation providers, who can help to reduce traffic demand by rerouting traffic, for example.

3

Static congestion charging schemes

Traditional schemes may deter some drivers from entering charging zones, but they frequently cause traffic jams and bottlenecks around the perimeter or during evenings or weekends when charges do not apply. Equally importantly, many schemes fail to account for traffic and its impact on congestion within the restricted zone. Notably, some large-scale schemes have seen private vehicles gradually being replaced by electric delivery vehicles and taxis which do not add to air pollution, but which continue to have a major impact on congestion and journey times.

Making mobility more sustainable with 'joined-up' traffic management

Joined-up traffic management is about connecting partners, systems, data, and capabilities to increase supply of road capacity and – crucially – to reduce demand at the same time. It works by deploying and connecting to an umbrella system that pulls in data from a wide range of sources, analyses it in real time, and triggers actions and responses to keep traffic flowing. Using mobile apps and connected vehicle data, real-time traffic information can be communicated to road users, and authorities can suggest alternative, greener forms of transport that may be faster or more cost effective. This can help authorities to encourage a shift in motorists' road-usage behaviour, thereby smoothing out the demand curve or even reducing overall traffic volumes over time.

While the theory of connecting multiple traffic management organisations and a wide range of traffic data is compelling, it is also a complex proposition. As well as implementing a platform that is capable of integrating organisations, systems and data, authorities also need access to specialists who can connect diverse systems and data, as well as AI algorithms capable of processing and analysing data from multiple sources in real time.

The key to connecting partners, systems, and data is to understand the inherent challenges of such projects, and to ensure that the specific skills sets involved are available. Additionally, many authorities will choose to start small with a limited sub-set of partners or datasets, making projects more approachable, simpler and less expensive to roll out, and delivering 'quick wins' that deliver value for stakeholders and road users.

By taking these steps, authorities can begin to roll out joined-up traffic management initiatives based on:

Connected transport partners

Many intelligent traffic management schemes aim to integrate key partners such as local authorities and emergency services to ensure fast responses to traffic incidents. However, additional partners such as public transport providers, navigation partners, and others, can be integrated to support coordinated responses to traffic congestion and, where possible, to promote greener transport options to reduce emissions and improve air quality.

Connected traffic management capabilities

In terms of the traffic management itself, there are a variety of tools that can be used, including traffic signals optimisation, mobile apps to communicate traffic status or alternative transport options to road users, smart congestion charging schemes, and tolling capabilities. By connecting a range of different traffic management capabilities, authorities can mount holistic responses that support more effective demand management.

Connected traffic data

Choosing and connecting datasets can be a major challenge for authorities looking to improve their traffic management responses. Installing sensors and cameras at intersections and on gantries is notoriously expensive, and bespoke interfaces are needed to connect to other types of data, such as vehicle data from automotive OEMs.

One strategy that can help authorities achieve emissions 'quick wins' is to integrate with a data provider that provides a single point of contact to multiple, pre-integrated data sources. Alternatively, authorities can begin with one or two data sources, such as smartphone data and vehicle data, or data from the main public transport providers in the area – such as bus and tram providers. As a next step, authorities can also connect with navigation partners and others to support dynamic rerouting of vehicles during peak times.

In all cases, authorities looking to integrate and analyse data to support more effective traffic management need an umbrella system capable of connecting with and integrating data from multiple sources. AI algorithms are also needed to support real-time data analytics and decisioning to respond to changing traffic conditions in real time.

The top benefits of joined-up traffic management

Joined-up traffic management provides four key benefits when compared to stand-alone signalling, signage and congestion charging solutions:

1

Reduced congestion and emissions

With joined-up traffic management, it's possible to detect and react to changing traffic conditions in real time. This enables authorities to adjust traffic light timings, change signage and implement access and congestion charging parameters to keep traffic flowing as quickly as possible, delivering a 'quick win' of reducing emissions.

2

Incentivisation of greener transport options

Joined-up traffic management can be used to incentivise drivers to leave their cars at home. This can be achieved in a number of ways, either by allowing electric or non-polluting vehicles to use the road network free of charge, or by making the cost of driving highly polluting vehicles prohibitive.

3

Improved air quality

With joined-up traffic management, authorities can integrate environmental data from sensor stations and models into the traffic management strategy, and predict how air quality will change in the coming 30 minutes on a rolling basis. By combining traffic and climate data, it also becomes possible to understand how long the air quality issues are likely to persist based on expected weather and traffic conditions. Based on this information, access controls or congestion charges can be adjusted to smooth out demand and to ensure that air quality remains above defined limits.

4

Increased road capacity that can be used for green transport options

Joined-up traffic management uses sophisticated measures, such as dynamic charging, to flatten the traffic demand curve throughout the day. This frees up space on the road network for bus lanes, bike lanes, and other options that reduce dependence on private vehicles and support emission-reduction targets. Parking restrictions can also be implemented at peak times to reduce traffic demand in city centres and other traditionally congested areas.
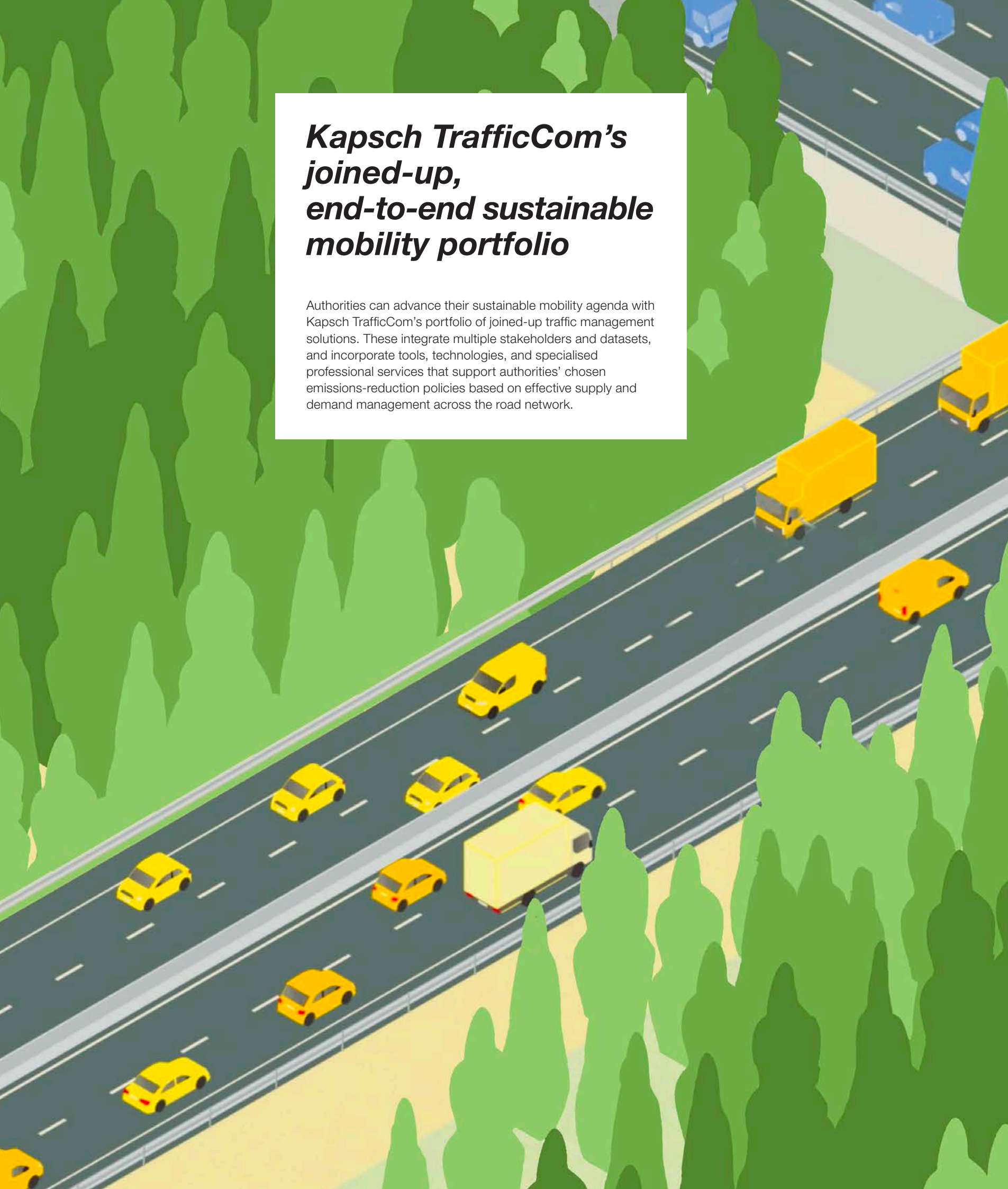
[5]https://www.nature.com/articles/s41558-020-0797-x

The short and longer-term impacts of COVID-19 on traffic demand

In spring 2020, cities and countries around the world introduced lockdowns and other anti-COVID-19 measures. The result was an immediate reduction in vehicle emissions, in some cases up to a 26% lower than normal, pre-pandemic levels[5].

Although the immediate impact of the pandemic on emissions was 'positive', the situation is changing rapidly. Not only has traffic returned to pre-pandemic levels in many cities and countries. But surveys also show that many people are less willing to use public transport than previously due to the infection risk – putting even greater demand on road networks.

As dependence on private vehicles continues to grow worldwide, no city or highways authority can be complacent about the growing emissions challenge.

Kapsch TrafficCom's joined-up, end-to-end sustainable mobility portfolio

Authorities can advance their sustainable mobility agenda with Kapsch TrafficCom's portfolio of joined-up traffic management solutions. These integrate multiple stakeholders and datasets, and incorporate tools, technologies, and specialised professional services that support authorities' chosen emissions-reduction policies based on effective supply and demand management across the road network.

1 Traffic Management

The Kapsch TrafficCom Traffic Management portfolio includes infrastructure and systems – including traffic monitoring and signal optimisation systems – that govern or enhance the flow of private, commercial, and public transport vehicles around a city or highway network. Our traffic management solutions have been used by city authorities to optimise capacity on the road network, providing incremental reductions in emissions and speeding up journey times.

2 Integrated Mobility Management (IMM)

Kapsch TrafficCom enables Integrated Mobility Management with umbrella systems that collect and analyse data from multiple traffic management and public transport systems – including trafficlight systems, signage systems, roadside cameras, and others. With data analytics that is connected to real-time decisioning tools, city and highways authorities can create a real-time, multi-modal view of traffic and transport and trigger more coordinated, timely, and effective responses.

3 Access management based on tolling

Our industry leading portfolio of smart access management solutions, which are based on smart tolling capabilities, helps city and highways authorities to smooth out the demand curve during peak periods. Additionally, authorities can use these solutions to ensure that the most polluting vehicles are restricted from entering certain sections of the road network, or – if required – subjected to higher charges than less polluting vehicles. Additionally, our access management and tolling solutions can help authorities fund infrastructure projects that improve traffic flow or reduce vehicle emissions, such as managed lanes, public transport infrastructure, and bicycle lanes.

4 Next-Generation Demand Management

Kapsch is currently developing a Demand Management solution that overlays traffic management, IMM solutions and charging schemes with sophisticated business logic and decisioning capabilities. This allows authorities to implement dynamic charging, per-mile charging, charging by vehicle type, managed lanes that permit high occupancy and green vehicles, and other sophisticated measures that reduce traffic demand and deliver significant reductions in emissions and air pollution.

Joined-up traffic management in action

Fighting emissions with a Kapsch Integrated Mobility Management (IMM) solution in Madrid, Spain

Initial situation

Madrid wanted to reduce demand across its heavily congested road network to reduce climate damage and to improve air quality for local people. As a quick win, the city needed to fight continuous congestion during peak times, and increase ridership of trams and other public transport services.

Solution and positive impact

To minimise congestion, reduce pollution and public health risks, and improve road user experiences by speeding up journey times, the City of Madrid has implemented an innovative Integrated Mobility Management (IMM) solution from Kapsch.

One key element of the solution is real-time adaptive signal control, which allows traffic light timing to be adjusted based on current traffic flows and queues. This has helped Madrid to reduce delays and stops, reduce journey times and reduce emissions.

Together, these benefits have helped to improve quality of life for local citizens, both in terms of reduced congestion and pollution, as well as reduced risks of accidents.

Reducing traffic demand and related emissions in London, UK, with next-generation congestion charging

Initial situation

More than 2 million Londoners, including 400,000 children, live in areas which exceed current air pollution limits. Additionally, more than 450 state schools in the city are in areas with dangerously high air pollution levels.

To minimise public health risks stemming from high levels of vehicle pollution, Transport for London (TfL) is investing heavily in public transport services. Experts from the Centre for London are also expanding the city's congestion charging scheme beyond the city centre and adding sophisticated new policy capabilities to reduce traffic demand as much as possible.

Solution and positive impact

By supporting 'mileage-based' charging based on the environmental and congestion cost of every journey, the updated congestion charging scheme will reduce overall traffic volumes in restricted zones. The scheme will also be integrated with the rest of the city's transport system, making it easier to propose alternative travel options and to encourage drivers to leave their cars at home wherever possible.

Over time, this will help to promote public transport, walking and cycling, and make it possible to incentivise a substantial reduction in vehicle usage and harmful emissions.

Cutting CO_2 emissions by 9,400 tons a year and gaining $250 million ROI in Dallas, Texas, USA

Initial situation

Dallas and surrounding counties, towns and cities form a metroplex that already have a population of 6 million inhabitants, generating major traffic issues on the roads network. This is specifically the case on US75, a major traffic corridor that runs north of the city.

To reduce congestion and speed up journey times on this critical corridor, a local authorities consortium decided to implement an innovative approach, funded partly by Federal Highways Administration, named Integrated Corridor Management (ICM) as a new, map-based, multi-model mobility and incidents management system.

Solution and positive impact

The mentioned consortium agreed to share information regarding private traffic and public transit and implemented Kapsch TrafficCom's EcoTrafix solution to achieve its mobility management goals. By gathering, analysing, and sharing data from weather systems, roadside detection systems, patrol cars, traffic and transit, and events the solution supports real-time, coordinated responses to congestion and incidents. Road users are also provided with real-time traffic information – including travel times for multi-modal trips (car, bus, etc.) – to encourage modal-shift and balance demand.

With real-time traffic information, real-time diversion of routing, and multi-modal alternatives to using private cars, Dallas has significantly reduced congestion on the 28-miles test-bed US75.

Even though ICM only manages incidents and unexpected disruptions, savings already account for 1% CO_2 in the regarded area. To put these numbers into perspective, the project covers about 10% of the greater Dallas region.

Key outcomes of the project include, as annual effects:

> **$250 million ROI over 10 years**

> **740,000 travel hours saved**

> **981,000 gallons of fuel saved**

> **9,400-tonne reduction in carbon emissions**

Priced managed lanes in Austin, Texas, USA

Initial situation

Loop 1 (MoPac) is the oldest and most congested roadway in the Austin area. Traffic on the corridor is projected to reach 220,000 vehicles a year by 2035[6]. With no space for building extra lanes, the local authority determined that a high-occupancy (HOT) lane in each direction would be a viable solution to the congestion challenge.

Solution and positive impact

Working with Kapsch TrafficCom, Austin has created the MoPac Express Lane (MEL). This uses a dynamically priced tolling scheme based on supply and demand. The toll tariff is modulated according to business rules so as to reflect the level of demand on the roadway (congestion corresponding to the highest tariff, fluid traffic to the lowest one). In addition, certain vehicles are able to use the MEL free of charge, including high-occupancy vehicles, low emission vehicles, motorcycles, Capital Metro buses, and registered car and van pools.

> **Key benefits of the project include:**
>
> **>** **Improved throughput, leading to reduced traffic congestion**
> **>** **Enhanced mobility and trip reliability**
> **>** **Increased revenue generation for the city**
> **>** **Always-on reliability, based on a technology architecture with no single point of failure**
> **>** **Scalability to support future growth in the managed lanes network**

[6]https://www.mobilityauthority.com/upload/StoryOfMopac-05_09_19.pdf

Traffic speeds increased by up to 30% at peak times in Mumbai, India

Initial situation

Mumbai is one of the world's largest cities with more than 18.4 million people. The number of cars in the city is growing by 10% year on year, creating major congestion and emissions challenges.

To reduce congestion and speed up journey times, Mumbai authorities wanted to monitor traffic more effectively at key junctions across the city, and to speed up responses to incidents that block traffic flow.

Solution and positive impact

The city of Mumbai worked with Kapsch TrafficCom to roll out a new urban traffic management (UTM) solution. This includes cameras and sensors at 253 key junctions across the city, with real-time traffic information delivered to a traffic-management control centre and adaptive intersections timing.

With a real-time view of traffic conditions, the city has reduced congestion – helping to increase traffic throughput and reduce accidents. The solution has also enhanced scheduling of road maintenance, further reducing traffic build up.

> **Key outcomes of the project include:**
>
> **>** **Up to 30% faster traffic flow in peak hours**
> **>** **63% ROI on project costs each year**
> **>** **The project was voted 'Best IT System' by the Government of India**

Managing traffic demand in a major European city

Initial situation   > ongoing project

A large, densely populated European city with millions of inhabitants needs to reduce congestion to reduce travel times and to curb emissions from idling vehicles. Additionally, city authorities aimed to reduce traffic demand overall and to promote the use of green transport alternatives.

Solution and positive impact

Kapsch was chosen to install a sustainable Demand Management solution that uses next-generation sensors and vehicle data to adjust signals for optimal traffic flow. A smartphone app also helps drivers to optimise their speed and braking for traffic lights, further reducing congestion.

The city is also looking at the possibility of deploying a number of charging zones to further reduce traffic demand. In tandem with campaigns to promote the use of public transport, these kinds of schemes can help cities to smooth out peaks in traffic volumes and reduce related emissions.

Why authorities are choosing Kapsch TrafficCom as a key sustainable mobility partner

At Kapsch TrafficCom, we are fully committed to supporting authorities on their sustainable mobility journey. We do this with our end-to-end traffic management ecosystem that not only increases supply on city and highway networks, but also drives down traffic demand incrementally to support any emissions-reduction strategy.

There are four key reasons why authorities around the world are choosing Kapsch TrafficCom as a strategic sustainable mobility partner. These are:

1

The unique breadth and depth of our joined-up traffic management solutions

While many technology partners offer specific traffic management solutions – from congestion charging to signal optimisation – Kapsch TrafficCom provides all of the technologies, tools, and skills needed to implement joined-up traffic management solutions. This gives authorities a single point of contact and responsibility for projects of all types and sizes, helping to streamline project delivery and reduce deployment time and cost risks. Despite our end-to-end offerings, Kapsch TrafficCom can also support specific elements of a traffic management project or scheme, from integration of vehicle or smartphone data, to deployment of sensors at intersections, for example.

2

Our joined up traffic management approach, which supports vehicle emissions 'quick wins'

By providing the toolsets and skills needed to integrate transport systems, partners, and datasets, Kapsch TrafficCom is able to support a uniquely coordinated solution to growing traffic demand. With fast action needed on climate change and air pollution in cities, our ability to integrate signalling optimisation, diverse vehicle routing, congestion charging, and a range of other effective solutions provides clear advantages over stand-alone or siloed traffic management approaches.

3

Our unique combination of IT expertise and transport industry knowledge

At Kapsch, we have a wealth of experience delivering large-scale traffic management schemes for major world cities. Our combination of technical expertise and industry knowledge means we can create and deploy end-to-end solutions that support authorities' specific climate and air quality goals.

4

Our focus on optimizing and managing overall traffic demand and vehicle emissions globally

With our sophisticated Demand Management solutions, Kapsch TrafficCom is able to help authorities reduce overall traffic volumes and to free space on the road network for priority lanes, bus lanes, cycle lanes, and other greener transport options that support the carbon-reduction and air quality agendas.

The future of traffic management is joined up

Vehicle emissions are making a large and growing contribution to climate change and poor air quality in cities around the world. Tackling this major challenge will require broad-based policy changes and investments in alternative, greener transport modes – backed up by education and incentives for populations to alter their road-use behaviour.

But while the scale of the challenges often seems overwhelming, vehicle emissions can be reduced in the short term with the right, joined-up management solutions. In particular, the right Demand Management solutions and policies can flatten the demand curve throughout the day or week, and significantly discourage the use of private vehicles over time in favour of greener alternatives.

Take the next step on your sustainable mobility journey with Kapsch

We trust you found this guide relevant and interesting. If you would like to understand more about joined-up traffic management and how Kapsch TrafficCom can support your decarbonisation and air quality goals, please contact us today. You can also find out more about our traffic management portfolio at https://www.kapsch.net/ktc/Portfolio/IMS.

It's time to act

Contact our experts for further information and to understand the benefits our solutions bring to your specific situation:

ktc.experts@kapsch.net
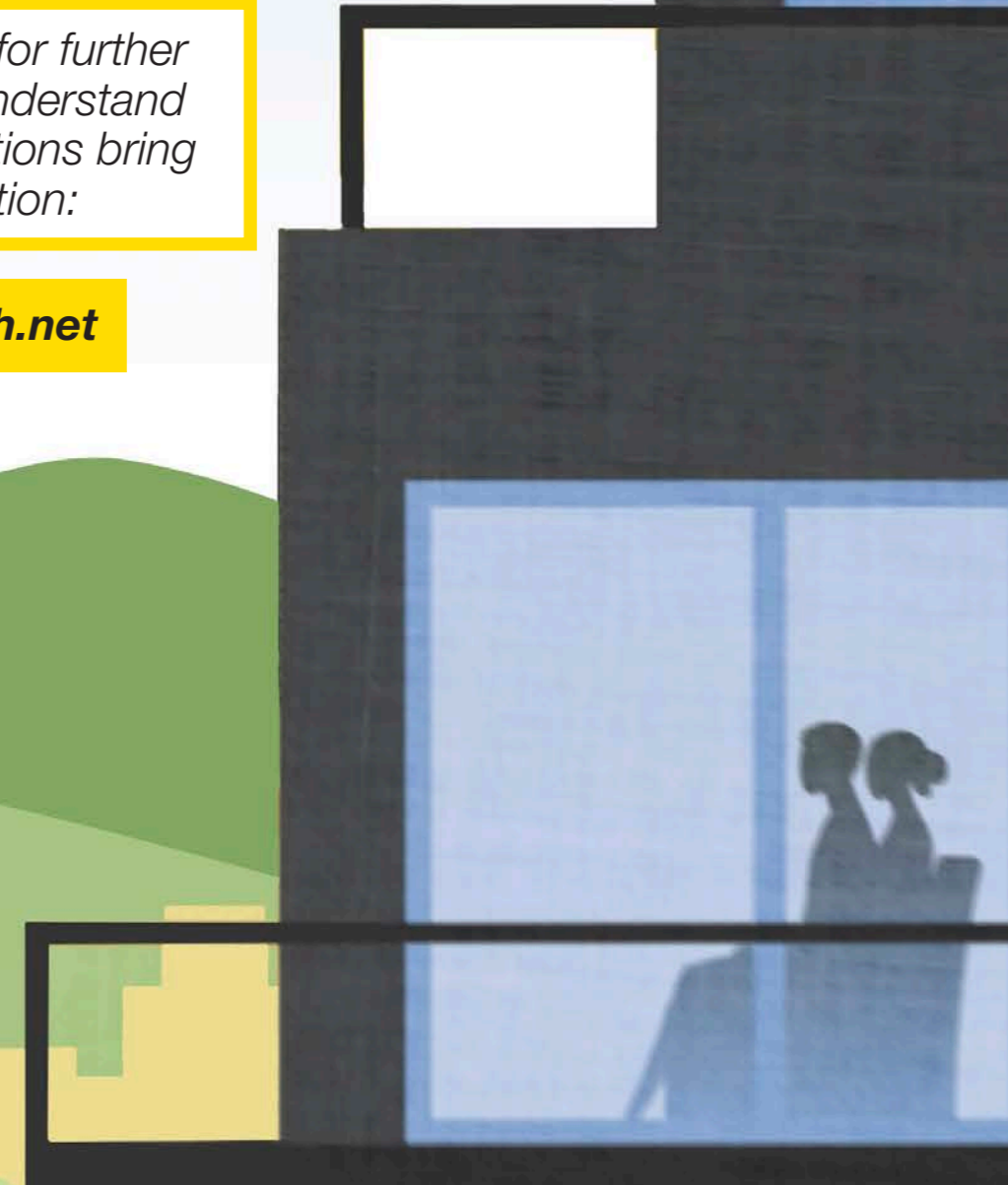
Kapsch TrafficCom

Kapsch TrafficCom is a globally renowned provider of transportation solutions for sustainable mobility. Our innovative solutions in the application fields of Tolling, Traffic Management, Demand Management and Mobility Services contribute to a healthy world without traffic congestion.

We have brought projects to fruition in more than 50 countries around the globe. With our one-stop solutions, we cover the entire value chain of our customers, from components to design and implementation to operation of systems.

As part of the Kapsch Group and headquartered in Vienna, Kapsch TrafficCom has subsidiaries and branches in more than 30 countries. It has been listed in the Prime Market segment of the Vienna Stock Exchange since 2007 (ticker symbol: KTCG). Kapsch TrafficCom's about 5,100 employees generated revenues of EUR 731.2 million in financial year 2019/20.

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