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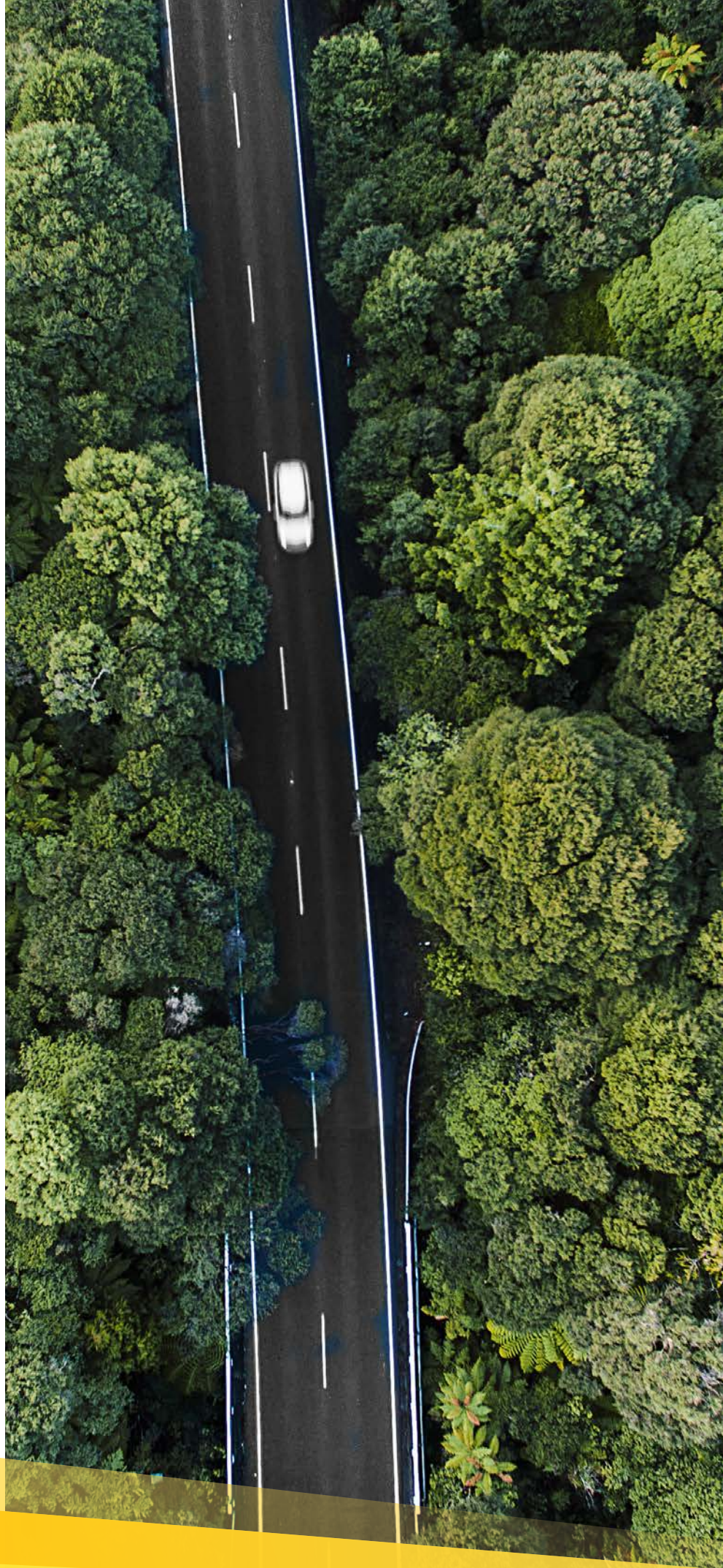
kapsch
challenging limits

Kapsch TrafficCom

Imagine a World without Congestion.

Mobility of the future.

Contents.



Introduction.

Dear reader,

Almost 70 percent of the inhabitants in New York, London, and Sydney are dissatisfied with the current traffic flow on roads, particularly in cities. Overcrowded streets and air pollution are having negative effects. Existing infrastructure is reaching its limits.

At the same time, megatrends such as the digital revolution are driving change at a rapid pace: citizens equipped with smartphones are now able to choose from a variety options to travel from A to B. In addition, climate and environmental protection urgently demands new ideas, which is why transport technology has a key role to play in providing innovative and sustainable solutions for the complex tasks of mobility today and tomorrow. This involves the seamless integration of all areas – intelligent transportation systems in the application fields of traffic management, electronic vehicle mobility transactions management, urban access and parking or road safety enforcement – to name only a few.

On the following pages, we will take a look at what people around the world expect from mobility in the future. Which strategies do people accept in the USA, Australia, South America, and Europe? Would drivers support and follow alternative routes on their navigation system to reduce congestion and improve air quality? How do drivers react when navigation technology takes over routing? How important is environmental protection for drivers and how can acceptance for tolling systems be improved?

Modern technology available today means that congestion does not have to be an inevitable part of commuting – it can be heavily reduced with modern traffic management systems.

Please feel free to reach out to us for intelligent and sustainable mobility solutions to solve your specific challenges. For a healthier world without congestion!

Yours sincerely,

Georg Kapsch
CEO, Kapsch TrafficCom

The Impact of Road Congestion.

Kapsch TrafficCom Index – 9,000 citizens around the globe surveyed.

Today, over 55% of the world's population lives in urban areas. By 2050, this figure is expected to increase to nearly 70%, adding some 2.5 billion more people living in cities.* This projection, combined with the growth of private car ownership in emerging markets, means there will be an unprecedented increase in traffic and pollution, heavily impacting the quality of life in cities more than ever.

Urban infrastructure cannot keep pace.

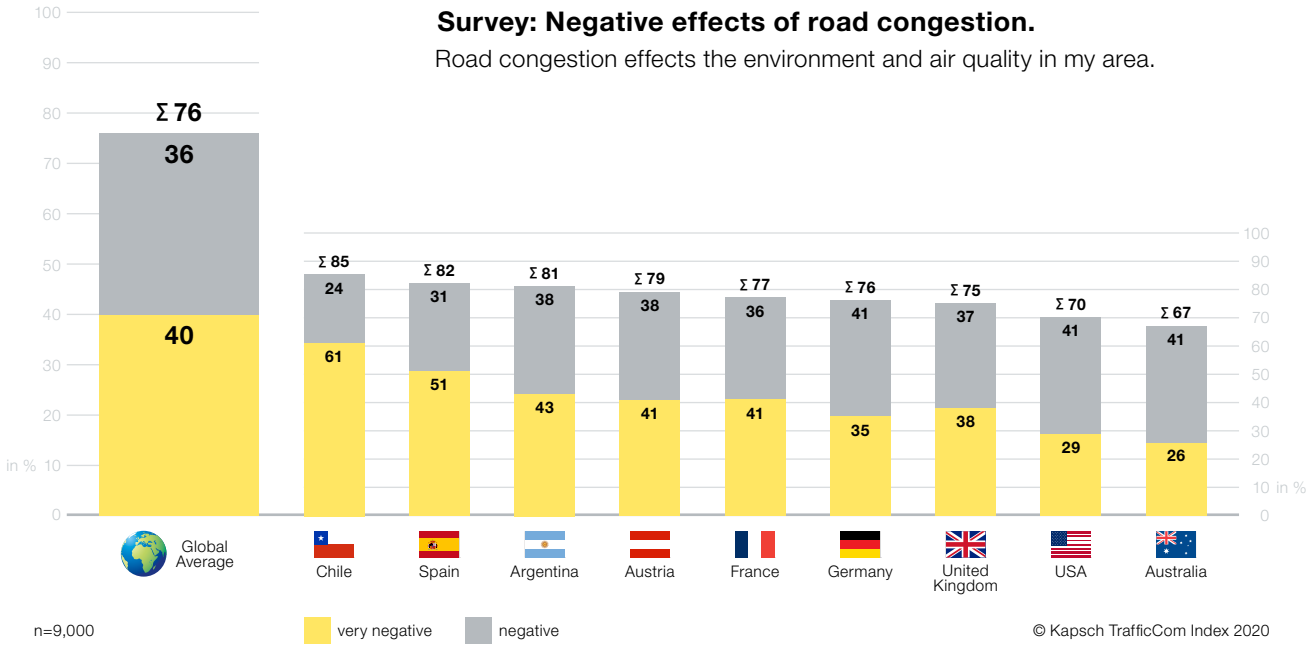
Citizens in the Americas, Europe, and Australia are not at all satisfied with the traffic flow in their countries. Nearly 70 percent are especially unhappy about congestion in city centers during rush hours. The top three negative effects people complain about: the environment and air quality suffer, travel times rise, and stress levels increase.

The Kapsch TrafficCom index wants to find out what citizens think about traffic today and in the future. The survey asked people about their current traffic situation, road congestion, the negative effects of emissions caused by traffic, and strategies to improve traffic management. What should government/municipalities do to reduce emissions, and what personal strategies exist to deal with mobility? The survey was conducted with the support of a professional market research institute.

A total of 9,000 participants in nine countries were questioned in a ratio reflecting each country's population: USA, Argentina, Chile, United Kingdom, Germany, Austria, France, Spain, Australia.

Survey: Negative effects of road congestion.

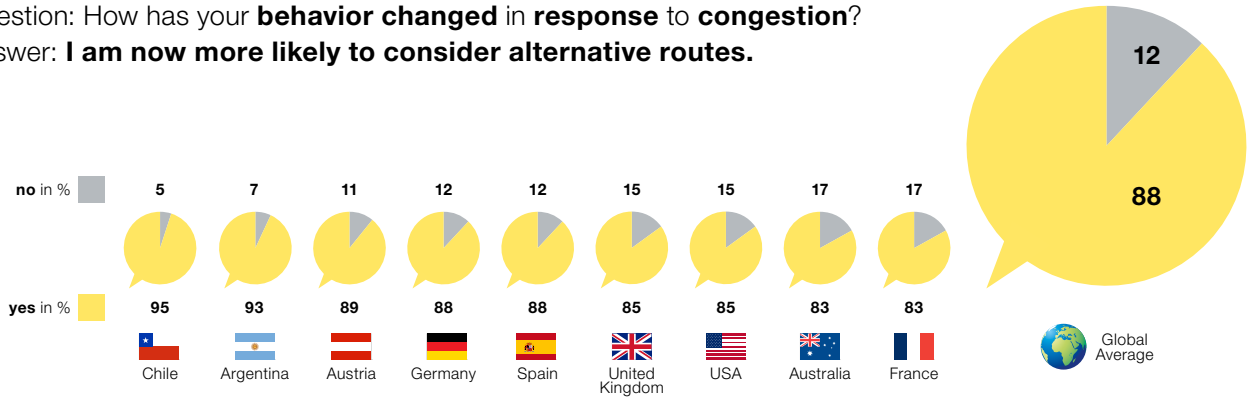
Road congestion effects the environment and air quality in my area.



Car drivers fed up with congestion worldwide.

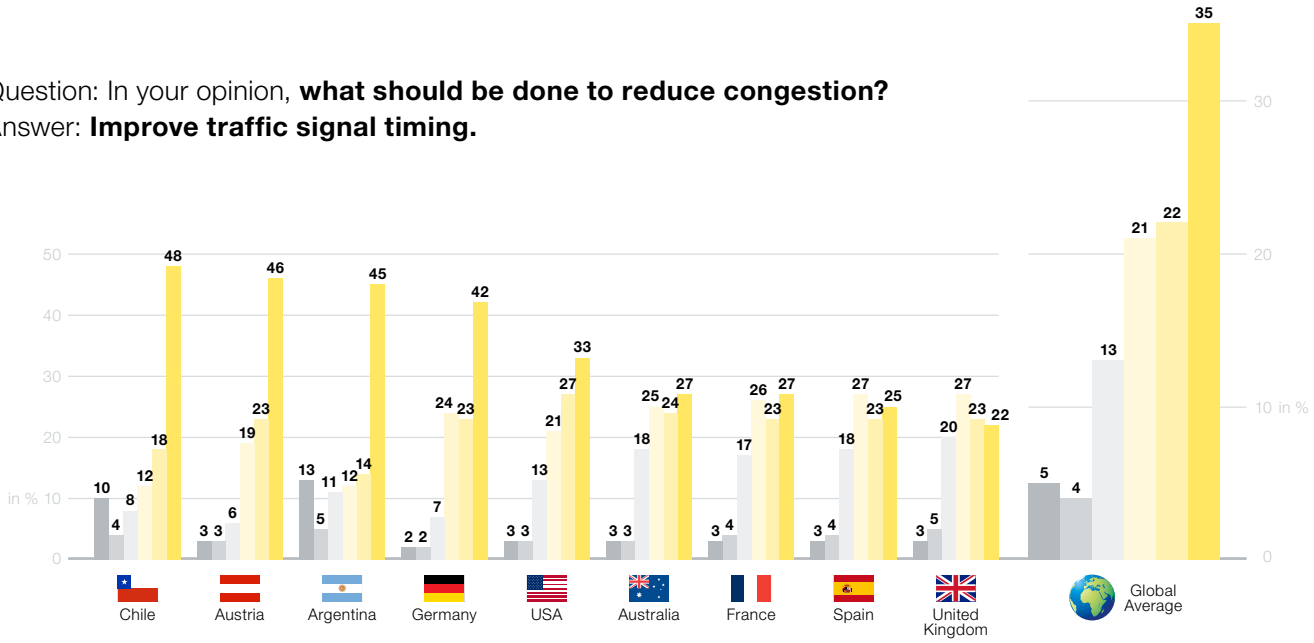
*Source: The 2018 Revision of World Urbanization Prospects, Population Division of the UN Department of Economic and Social Affairs (UN DESA) https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

Question: How has your **behavior changed** in **response** to **congestion**?
Answer: **I am now more likely to consider alternative routes.**



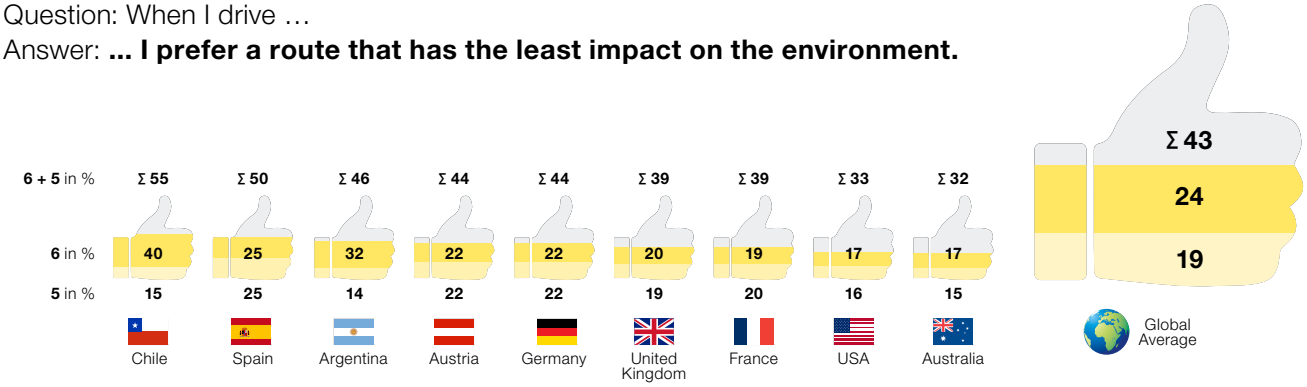
n=9,000

Question: In your opinion, **what should be done to reduce congestion?**
Answer: **Improve traffic signal timing.**



n=9,000 **Answer scale 1 to 6**: **1** strongly disagree **2** **3** **4** **5** **6** strongly agree

Question: When I drive …
Answer: **… I prefer a route that has the least impact on the environment.**

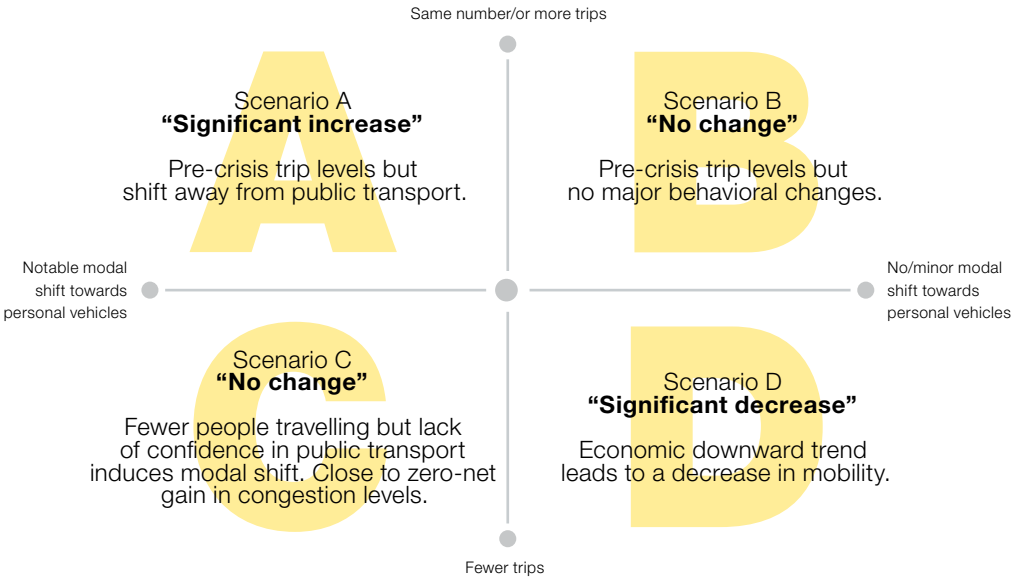


n=9,000 **Answer scale 1 to 6**: disagree to strongly agree **5** **6** strongly agree

Effects of Covid-19 Pandemic on Congestion.

Four scenarios outline possible impacts on congestion.

The Covid-19 pandemic has markedly reduced travel. Short-term changes in travel behavior include more people working from home, fewer non-essential trips being made, and a significant decrease in transit ridership. But has this development the potential to substantially change our mobility behavior? As we try to anticipate travel patterns in a post-Covid world, we propose four potential future scenarios.



Scenario A – Increase in personal vehicle trips and congestion.

Communities rebound from short-term impacts on travel and working from home due to Covid-19. The international free movement of persons and goods is rebuilt and the number of leisure trips and commuters reaches pre-crisis level as the majority of employees cease working from home. Due to the fear of infection, people avoid using public transport, with shared mobility concepts and other mobility services also falling short of former levels. The numbers of car registrations increases and so does roadway congestion. Traffic jams and delays surpass pre-crisis levels. Hence the temporary increase in people cycling and walking tails off as the general conditions for these forms of mobility worsen. Cities and the environment suffer from this unfavorable development.

Scenario B and C – Pre-crisis levels maintained.

In these two scenarios, we foresee congestion returning to pre-covid levels. Scenario B predicts a V-shaped economic recovery with activity rebounding to pre-crisis levels with travelers returning to their former habits and routines. Neither the number of essential and non-essential trips nor the modal split is substantially altered. In scenario C, we experience even fewer reasons to travel. A relevant percentage of work-related mobility is substituted by work from home or disappears entirely because of crisis-driven unemployment. However, the usage of the individual transport modes, like bikes or cars, increases due to people avoiding public transport and other means of collective or shared mobility for preventive reasons. In both these scenarios, the net effect is a return to prior congestion levels.

Scenario D – Overall decrease.

Covid-19 has created the worst global economic recession since the depression. Unemployment has risen, some countries have major industries that have laid off workers and small businesses have been battered. As the medical community works to develop cures and vaccines for the virus, a significant part of the remaining workforce continues to work from home. Non-essential personal trips have declined to record lows, people are still being encouraged to practice social distancing. During this economic downturn, congestion on the world's major routes have declined. Major traffic jams have all but disappeared as there has been a significant reduction in traffic volume.

Summary.

Improving personal mobility by reducing urban congestion is a primary focus of transport agencies. While congestion is normally a major problem, the Covid-19 pandemic has led to significant short-term reductions in personal travel, resulting in noticeable improvements in network performance and air quality.

As the world recovers from the pandemic, we envision that it is likely over the long-run for personal travel to rebound and approach pre-crisis congestion conditions. In the interim, we have a golden opportunity to experience a world with less congestion and strategize ways to change travel behavior and make our transport systems more efficient and resilient so we can improve mobility for everyone.

A World without Congestion: Strategies and Solutions.

70% of the world's population live in urban areas by 2050. Traffic impacting life in cities more than ever.

Today, over 55% of the world's population lives in urban areas. By 2050, this figure is expected to increase to nearly 70%, adding some 2.5 billion more people living in cities.* This projection, combined with the growth of private car ownership in emerging markets, will lead to an unprecedented increase in traffic and pollution, heavily impacting the quality of life in cities more than ever.

Urban infrastructure cannot keep pace.

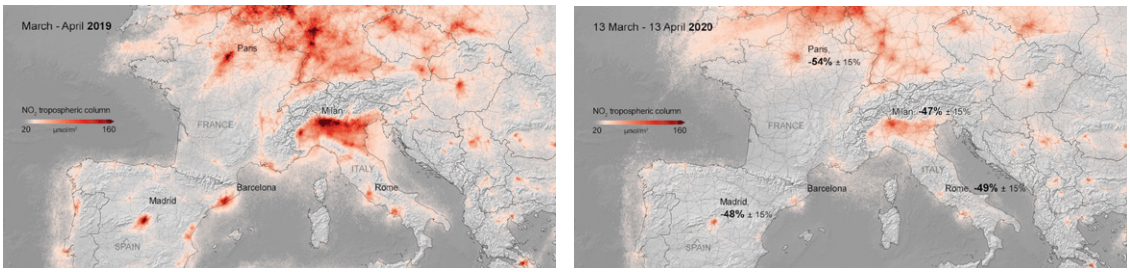
It is already evident that urban infrastructure capacity cannot keep pace with this demand, presenting major challenges that urgently call for the implementation of policies supporting sustainable growth. The urban environment indeed poses the biggest challenges to the sustainability of transport, as cities currently suffer the most from congestion, poor air quality, noise exposure and impaired road safety – all as a result of traffic.

Congestion is known to have a negative impact on the economy through lost time, reduced productivity, public health costs, and wasted fuel. The European Union (EU) estimates this impact at over €100 billion p.a., equivalent of approx. 1% of GDP.**

Poor air quality causing health issues and loss of life.

Congestion also has a detrimental effect on public health due to pollutant emissions and increased stress levels. In the EU alone, urban transport accounts for 40% of CO2 emissions of road transport and up to 70% of other pollutants from transport.*** The consequences are shocking: over 412,000 premature deaths in Europe every year caused by poor air quality (2019).

The impact of transport on congestion and air quality has sadly been made evident by the devastating Covid-19 pandemic. Figures published by the European Space Agency (ESA) in March 2020 reveal a significant drop in pollution levels across parts of Europe affected by lockdown measures that led to a huge decline in road traffic. The ESA notes a large decline in NOx pollution (emitted by cars, vans, and trucks); in some regions of Italy, Spain and France, NO2 levels fell by more than 50%.



Drop in pollution levels affected by lockdown measures.
Source: European Space Agency (ESA) https://images.app.goo.gl/iaSie8W85g3V3CUN7

*Source: The 2018 Revision of World Urbanization Prospects, Population Division of the UN Department of Economic and Social Affairs (UN DESA). https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html
**Source: European Commission Mobility and Transport, Urban Mobility. https://ec.europa.eu/transport/themes/urban/urban_mobility_en
***Source: Air quality in Europe – Report 2019, European Environment Agency. https://www.eea.europa.eu/publications/air-quality-in-europe-2019

How Can Congestion Be Managed?

Influencing drivers and their decisions.
No managing congestion without managing demand.

Policymakers have a range of economic and regulatory tools available to them to manage transport, such as taxation of fuel and vehicle ownership as well as regulation of vehicle use.

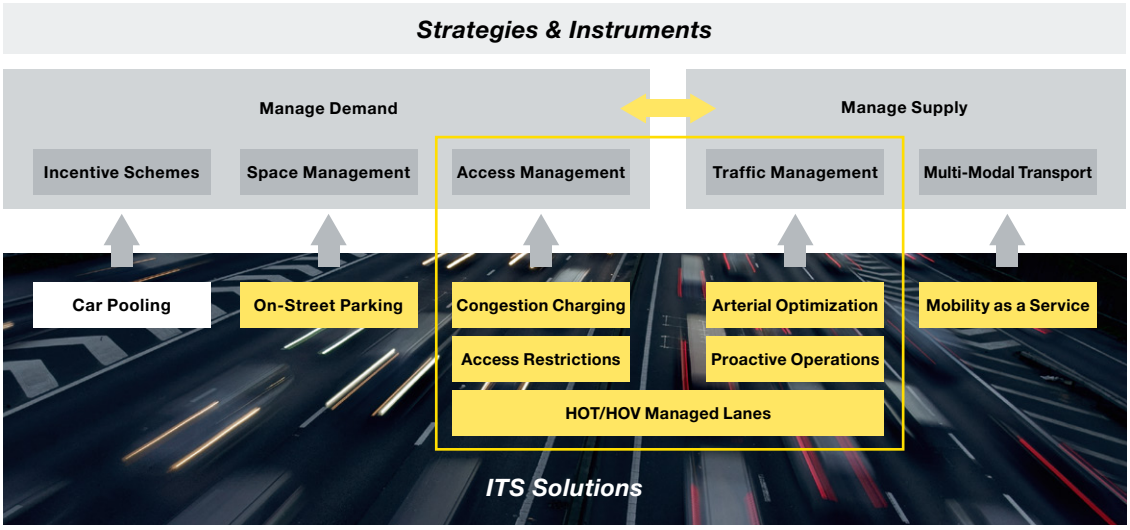
Policies need to influence drivers and their decisions.

However, effective mitigation of congestion requires influencing drivers and their decisions if, how and when to travel, while at the same time acknowledging that different types of transport will not respond to specific policies in the same way. Mitigating congestion is as much a social engineering puzzle as it is a technical challenge. While there is no one perfect solution, most strategies either focus on managing supply, providing new or freeing up existing capacity, or on managing demand to address the scarcity of capacity.

No managing congestion without managing demand.

A key principle for effective congestion management is that capacity-producing measures should always be accompanied by measures that manage demand for that capacity; in other words, there is no managing congestion without managing demand. This means they work best in combination, complementing and reinforcing each other.

We have identified three essential pillars to solving this conundrum: optimizing the road, optimizing the trips, and controlling demand by charging, incentivizing and/or regulating trips. The diagram below maps the most commonly applied instruments to these strategies today.



Common instruments of supply and demand management.

Also shown here are the respective Kapsch Intelligent Transportation System (ITS) solutions, providing an efficient and effective implementation of those instruments, harnessing our ITS expertise in traffic management, electronic toll collection, and transport operations.

Access and Traffic Management.

Key complementary instruments offer the best potential to reducing congestion.

Access Management and Traffic Management are two complementary instruments which we believe offer the best potential to reducing congestion.

Access Management allocates scarce road space.

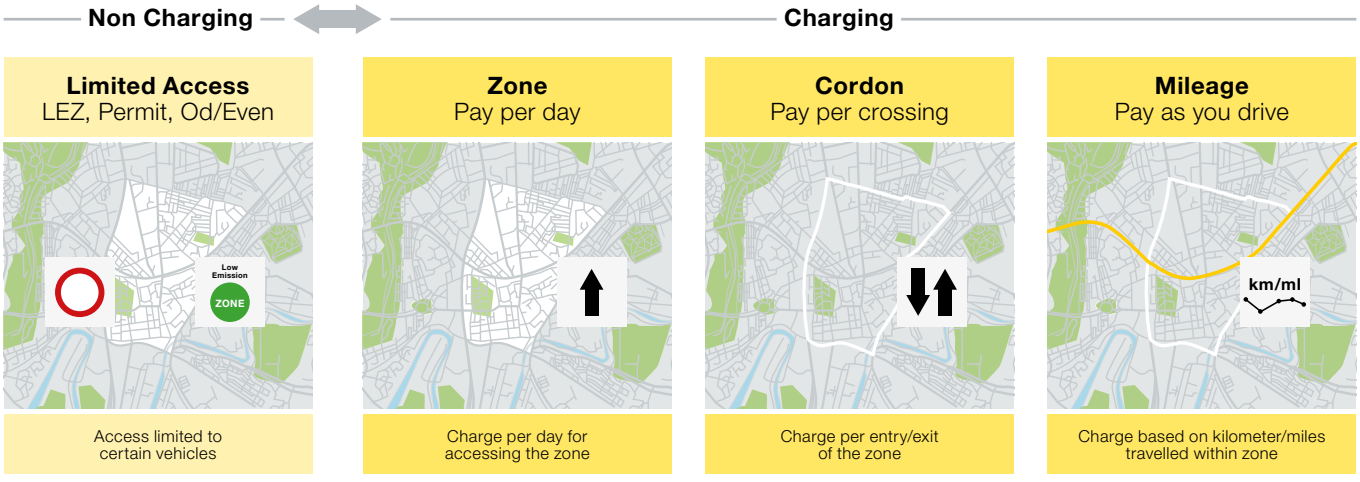
Access Management allocates scarce road space between competing users through the instrument of restrictions and/or pricing. It is a proven and effective tool of demand management that can serve a range of objectives in addition to congestion relief, such as environmental protection, revenue generation, road safety, and the modal shift to sustainable modes of transport.

Our many years of experience deploying urban traffic management systems and the insights thereby gained into congestion management have exposed an interesting pattern, in that under normal circumstances only a relatively small percentage (five to eight percent) of traffic causes congestion. Reducing that extra demand can help traffic flow by preventing arterials becoming a bottleneck and congestion spilling over to adjacent routes.

Non-charging and charging schemes.

Non-charging schemes are aimed at ensuring compliance with certain restrictions, such as limiting access into a designated zone for permit holders or residents only (Limited Access Zone), or for vehicles complying with emission standards (Low Emission Zones). Restrictions are typically enforced by means of license plate recognition cameras placed around the perimeter of the zone.

Charging schemes, on the other hand, employ pricing to control demand for access to congested urban areas. This sets them apart from non-charging schemes in that they can generate revenue not only to cover operational costs but also for investments into urban transport infrastructure and sustainable modes of transport.



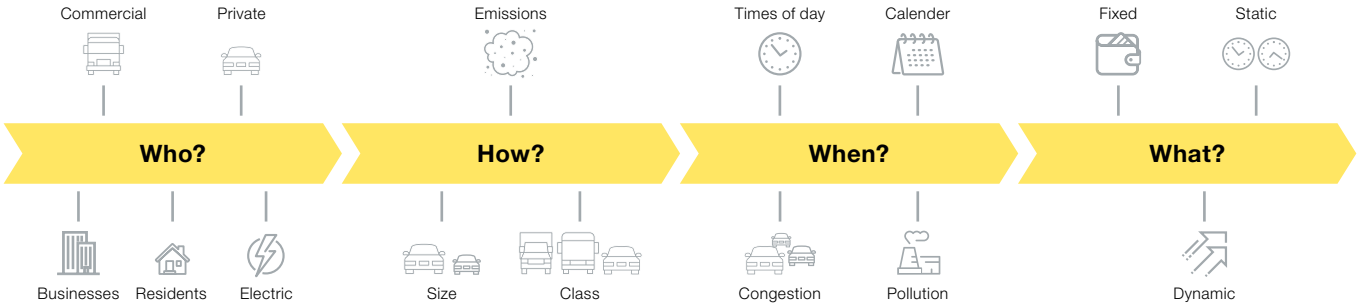
Operating and design principles of Access Management schemes.

Congestion Charging.

An effective yet controversial policy instrument: Pay as you drive as a fair means of charging.

Despite all its evident benefits, congestion charging remains a controversial policy instrument. Indeed, successful schemes, such as the ones in London or Stockholm, used a pilot phase to turn an initially negative public opinion into a positive one, having demonstrated significant reductions in congestion, the resulting time and costs savings, as well as additional revenues to finance public transport expansion and improvements.

Congestion charging can take various forms as far as its design and charging principles are concerned, i.e. who, how, when, and what to charge.



Congestion charging can take various forms.

Toll collection technologies.
Charging and enforcement rely on free-flow electronic toll collection technologies designed for both interurban and urban environments that Kapsch has pioneered for over two decades.

Although these designs have proven to be effective in reducing congestion, they do have a shortcoming that makes them considered by many as unfair, namely they do not account for traffic within the zone. This issue has been made more evident by the recent surge in ride-hailing services (the likes of Uber and Lyft), practically voiding the benefits of congestion charging through generating substantial traffic within the zone that simply escapes the charges.

Zone and cordon charging.
Mileage-based charging, or pay as you drive, could be a way of solving this issue and more. It is perceived by the public as a fairer method of charging and can thus make congestion charging more palatable.

Pay as you drive relies on GPS-enabled devices recording and reporting the distance travelled within a virtual geo-fenced zone. With smartphones being ubiquitous and the share of connected (GPS and mobile-data-enabled) vehicles growing by the day, road users today are perfectly equipped for mileage-based congestion charging.

The main challenge is the mapping in real time of a massive number of vehicle locations onto the chargeable zone within a complex urban road network in a reliable, accurate, and secure manner to ensure correct charging and to satisfy privacy concerns surrounding being tracked. These demands are efficiently met by the Kapsch Geolocation Platform, representing a powerful platform for intelligent location-based mobility services.

Traffic Management.

New generation of data-driven traffic management solutions to maximize supply and optimize usage of capacity.

Traffic management is a fundamental instrument of managing supply, primarily concerned with the provision and optimization of road network capacity. As such, it has great potential to reduce congestion, especially in combination with demand management measures.

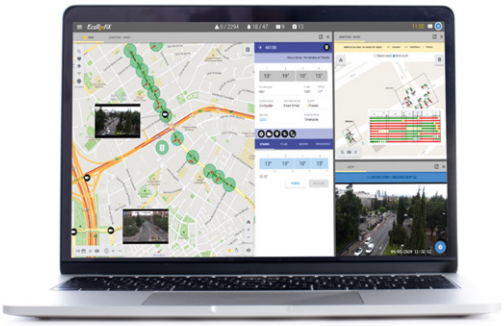
Our mission at Kapsch is to leverage our expertise in traffic engineering, both planning and operational, to deploy solutions that combine data processing, analytics, machine-learning, and advanced decision support, to show our customers new ways of understanding and managing traffic to reduce congestion and associated emissions.

Here we explore a number of advanced traffic management solutions aimed at reducing congestion effectively.

Signal timing adapted to real-time traffic.

Arterial optimization methods deal with maximizing the available supply of capacity to arterials in the network. These are critical to controlling congestion as they carry the most traffic during peak hours and are thus prone to becoming a bottleneck when demand exceeds their capacity.

However, the way many urban transport agencies manage traffic has barely evolved over the last 20 years. Traffic signals in many cities are still mostly static, applying fixed timing plans updated every 3 to 5 years, with virtually no connection to drivers and vehicles. Implementing robust green waves with such aged technology remains a challenging prospect. Adaptive signal control has been around for decades, applying near real-time changes to signal timing parameters in response to traffic flow. Today, a new generation of solutions aided by state-of-the-art machine learning by Kapsch helps agencies identify underperforming intersections and generate improvement measures in an automated manner, allowing a reduction in the update cycles of signal timing plans. Even minor adjustments in signal timing can reduce travel times and avert stop & go traffic, leading to a welcome reduction in pollutant emissions owing to steady travel speeds.



Adaptive signal control also helps reduce emissions.

Moving from reactive to proactive operations.

Proactive operation essentially means taking action before incidents or events leading to congestion are likely to happen. Moving from reactive, the status quo today, to proactive operations means that major changes are needed to the way mobility is managed. Enabled by predictive analytics, proactive operations can significantly reduce the impacts of incidents on congestion, on delays, and the resulting spike in pollutant emissions.

Demand Management.

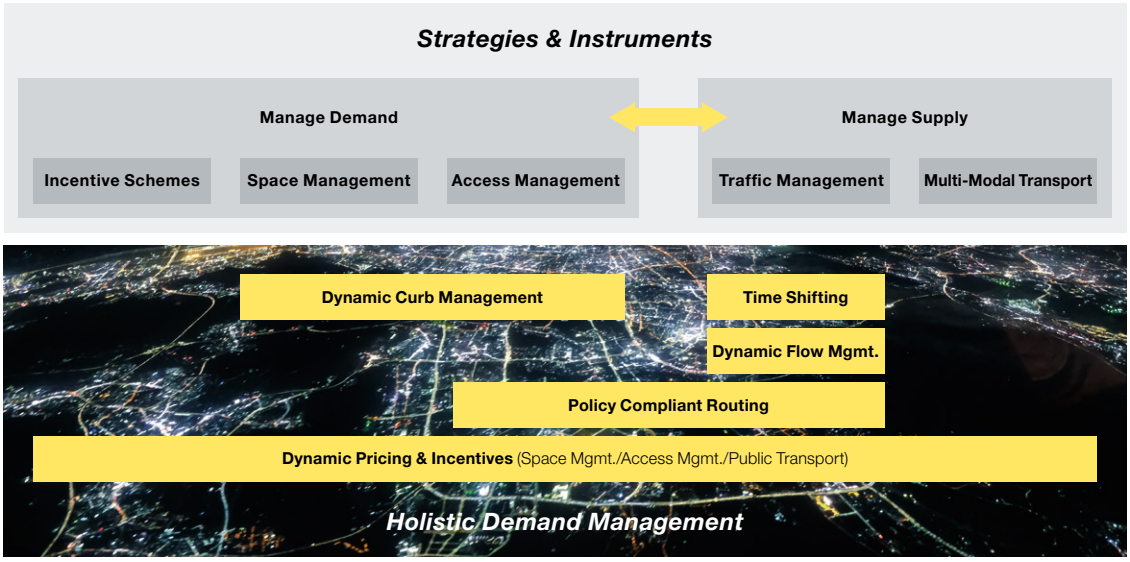
Smart integration of supply and demand instruments: Data and insights enable intelligent decisions.

The importance of supply and demand instruments working in combination, complementing and reinforcing each other must be emphasized again. However, these instruments today are still being managed in separate silos, often by different authorities and agencies, lacking the necessary communication and coordination that would enable the full potential to be harnessed.

Holistic demand management.

Achieving a world without congestion is indeed an ambitious endeavor that requires a truly holistic mitigation approach, calling for smart, stepwise integration of the instruments acting on supply and demand. Such holistic demand management is what we believe will evolve to take center stage in urban mobility management.

Holistic demand management by Kapsch offers new and effective means of managing congestion, through solutions such as time shifting, policy-compliant and collaborative routing, managed lanes, and dynamic pricing, just to name a few.



Smart integration of instruments acting on supply and demand.

Data, insights, and decision intelligence.

Data is the oil of the digital era; a recognition very much central to the concept of holistic demand management. Vast volumes of raw data being generated by traffic systems are not being used efficiently today nor shared, leading to missed opportunities.

A data exchange hub, fed by real-time mobility relevant data, can generate the needed insights for intelligent decisions by means of operational tools that apply machine learning to aggregated (traffic and incidents) and raw (probe) data to help identify patterns, detect unplanned incidents and anomalies, make short to long-term predictions, as well as validate the impact of measures and suggest optimizations.

Timing, Routing & Pricing Journeys.

Shaping demand through social engineering.

We found that getting only three percent of road users to shift their departure time by just ten minutes during peak hours can significantly reduce demand to avoid major congestion. This is particularly relevant for likely bottlenecks, such as bridges, tunnels and egress arterials.

Time shifting reduces peak-hour volumes by influencing road users to shift the timing of planned trips. An additional benefit of social influencing techniques is their lasting effect, in that they tend to introduce long-term behavioral changes.

Intelligent routing.

Road users and travelers rely on the availability of accurate traffic information. A variety of commonly used services and tools provide that information, however, they all tend to suggest the same routes, leading to common bottlenecks.

Dynamic flow management is a method of intelligent routing to avoid saturation of main arterials through continuous evaluation and provision of recommendations to split traffic onto alternative parallel routes. By simply shifting vehicles to alternative routes, in coordination with the traffic agency, congestion, and so travel times, can be reduced.

Load balance by splitting traffic to alternative routes.

Dynamic pricing and incentives.

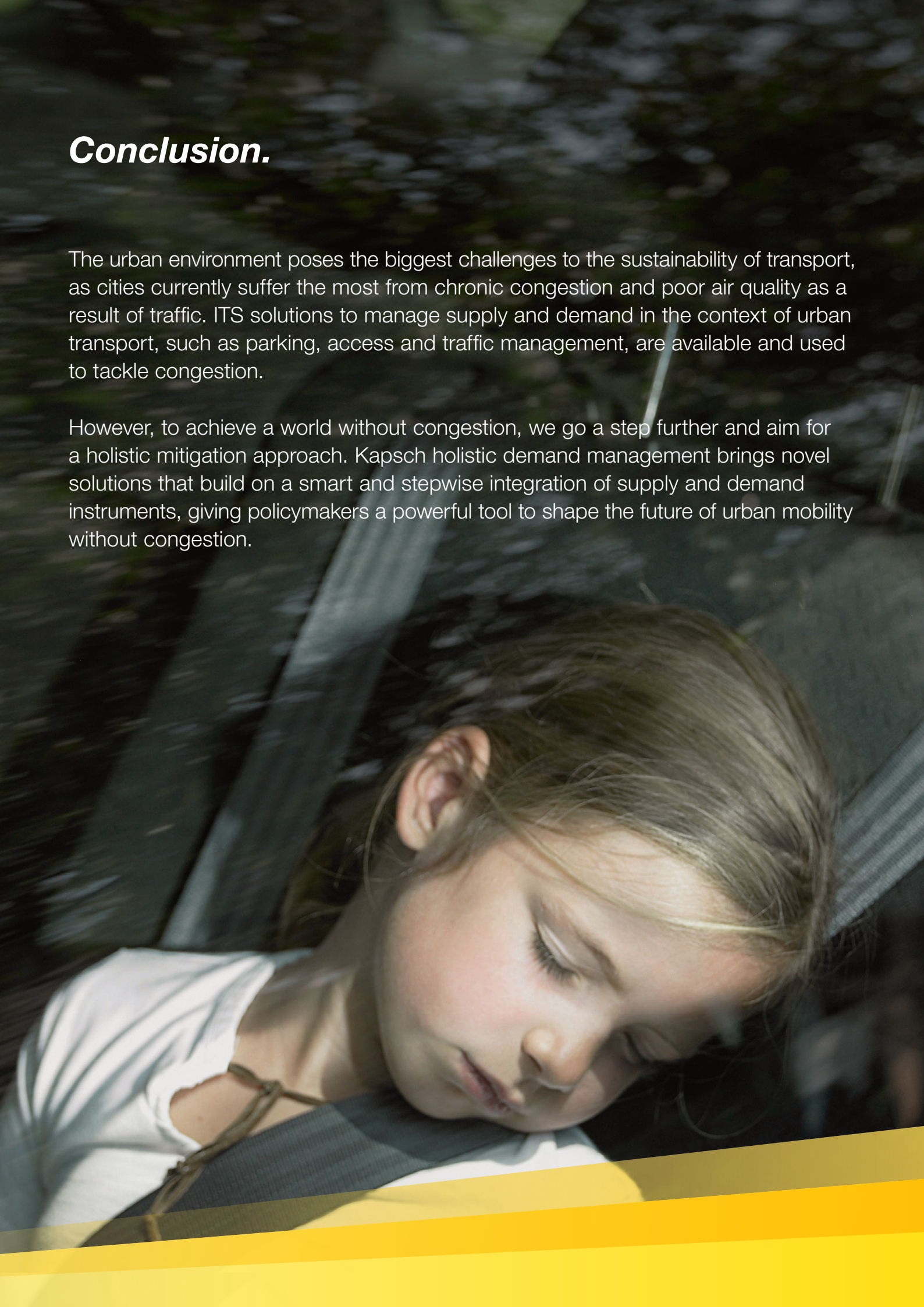
Dynamic pricing, applicable to a range of mobility services from public transport through parking to congestion charging, presents a particularly effective means of shaping demand as well as helping meet the service-level performance target.

In the context of congestion charging specifically, dynamic pricing allows reducing or even suspending charges in line with traffic and pollution levels, yielding a more acceptable scheme.

Conclusion.

The urban environment poses the biggest challenges to the sustainability of transport, as cities currently suffer the most from chronic congestion and poor air quality as a result of traffic. ITS solutions to manage supply and demand in the context of urban transport, such as parking, access and traffic management, are available and used to tackle congestion.

However, to achieve a world without congestion, we go a step further and aim for a holistic mitigation approach. Kapsch holistic demand management brings novel solutions that build on a smart and stepwise integration of supply and demand instruments, giving policymakers a powerful tool to shape the future of urban mobility without congestion.



Selected Success Stories.

Valladolid

Proactive Operations

Incidents Response Time

–15%

Bologna

Access Management

Congestion

–23–31%

Emissions (est.)

–47%

Bologna

Beirut

Jeddah

Medina

Makkah

Mumbai

Madrid

Adaptive Signal Control

Travel Time	Avg. Speed	Delay & Stops	Emissions (est.)
–5%	+4%	–19%	–10%

- **Adaptive Signal Control**
- **HOT/HOV Managed Lanes incl. Dynamic Pricing**
- **Dynamic Flow Management**
- **Proactive Operations**
- **Access Management**

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.

>>> www.kapsch.net

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