



RIYADH 2020
URBAN



Reshaping Mobility in Cities for a Carbon-neutral Future



Circular, Carbon-neutral Economy

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Figure 1.
The three-pillar framework towards sustainable urban transport





List of Definitions and Acronyms

Autonomous Vehicles (AV) – is a vehicle that is capable of moving safely with little or no human input.

Electric Vehicles (EV) – is a vehicle that uses one or more electric motors for propulsion.

Greenhouse gas (GHG) – are compound gases that trap heat or longwave radiation in the atmosphere. These gases cause the greenhouse effect, warming Earth's surface.

Intelligent Transport Systems (ITS) – application of technologies to sense, analyze, control, and communicate to ground transportation aiming at improving efficiency and enhancing safety.

Mobility-as-a-Service (MaaS) – is a concept that puts users at the core of transport services, offering them tailormade mobility solutions based on individual needs.

Particulate Matter (PM2.5 or PM10) – is a mixture of solid and liquid particles that are suspended in the air, i.e. air pollution. These are categorized into coarse, fine, and ultrafine. Coarse particles have a diameter of 2.5 micrometers to 10 micrometers and are relatively heavier and thus tend to settle.

Transit-oriented development (TOD) – is a type of urban development that maximizes the amount of residential, business, and leisure space within walking distance of public transport.



About Urban 20

Urban20 (U20) is a city diplomacy initiative that brings together cities from G20 member states and observer cities from non-G20 states to discuss and form a common position on climate action, social inclusion and integration, and sustainable economic growth. Recommendations are then issued for consideration by the G20. The initiative is convened by C40 Cities, in collaboration with United Cities and Local Governments, under the leadership of a Chair city that rotates annually. The first U20 Mayors Summit took place in Buenos Aires in 2018, and the second took place in Tokyo in 2019. For 2020, Riyadh City is the Chair city and host of the annual Mayors Summit. The first meeting of U20 Sherpas was convened in Riyadh, Saudi Arabia, on the 5th – 6th February during which the foundations were laid for the U20 2020 Mayors Summit in the Saudi capital later this year.

About the Urban 20 Taskforces

As U20 Chair, Riyadh has introduced taskforces to add additional structure and focus to the U20. These taskforces explore specific priority issues and bring evidence-based solutions to the final Communique.

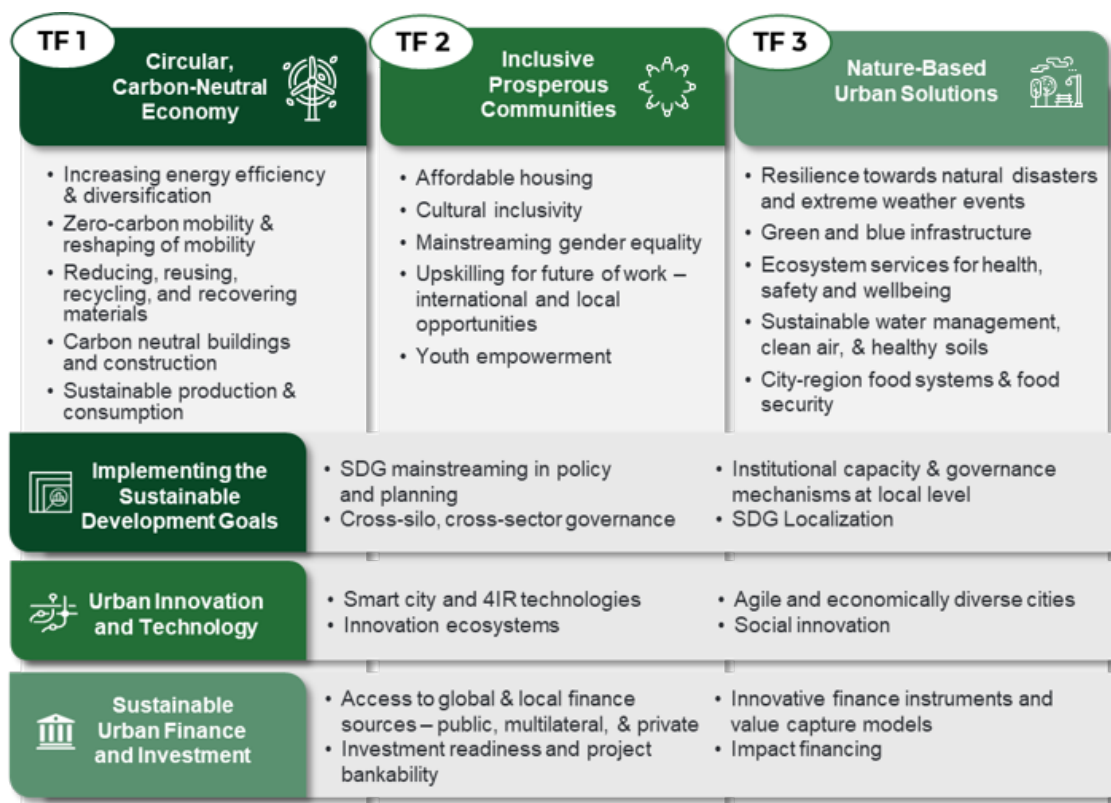
Each taskforce has commissioned whitepapers led by chair cities, and with input from participating cities and knowledge partners. These whitepapers help us build an evidence-based, credible and achievable set of policy recommendations.

Taskforces activation

The taskforces workstream was an innovative and recent introduction to the three-year-old U20 initiative by the chairmanship of the city of Riyadh this year. Three thematic taskforces, each guided by one of the U20 Riyadh 2020 overarching themes of Circular, Carbon-neutral economy, Inclusive Prosperous Communities, and Nature-based Urban Solutions, were officially launched and activated during the U20 First Sherpa meeting back in February. During the meeting, the U20 priority topics that fell within the three overarching themes and intersecting with the three cross-sectional dimensions of Implementing the Sustainable Development Goals, Urban Innovation and Technology, and Urban Finance and Investment were prioritized and refined through the statements delivered by all attending cities. The top 5 topics were then chosen to be the focus of whitepapers for each taskforce.



The top 5 topics under each of the three taskforces and cross cutting dimensions were then chosen to be the focus of whitepapers for each taskforce:



Cities and Partner Engagement

The vast majority of the twenty-three cities who attended the first Sherpa meeting, representing 12 G20 countries, along with the U20 Conveners, agreed to the importance of having taskforces as interactive platforms to produce knowledge-based and evidence-based outcomes that can effectively feed into an actionable U20 Communique. During and following the meeting, several cities demonstrated interest in volunteering in the capacity of chairs and co-chairs, leading and overseeing the activities of each taskforce. The cities of Rome and Tshwane co-chaired Taskforce 1 on Circular, Carbon-neutral Economy, Izmir

Taskforce 2 on Inclusive Prosperous Communities, and Durban on Nature-based Urban Solutions. Others expressed interest to participate in the taskforces, some in more than one, both during and after the meeting.

Alongside interested U20 cities, several regional and international organizations proffered to engage in the work of the taskforces, in the capacity of knowledge partners, to share their knowledge and experiences with cities in producing whitepapers. Some of the knowledge partners volunteered to play a leading role as Lead Knowledge Partners, supporting the taskforces' co/chairs in review and guidance



All participants who actively took part of the taskforces were subject matter experts nominated by the cities and knowledge partners and have enriched the taskforces' discussions with their know-how and experiences. In over 3 months, all three taskforces, with great effort and commitment from all their participants, produced a total of 15 evidence-based focused whitepapers, bringing about more than 160

policy recommendations addressing the national governments of the G20 Member States.

The taskforces content development efforts is comprised of 23 U20 cities and 31 U20 knowledge partners. The 100+ experts and city representatives produced 15 whitepapers which widely benefited and informed the development of the first draft of the communique.



Content Development

Under the leadership and guidance of the co-chair cities, Rome and Tshawne, and the lead knowledge partner, OECD, the work of Task Force 1 kicked off with an orientation for all participants in mid-March.

During the period between March and April, the participants of Taskforce 1 presented more than 20 concept ideas and 12 concept notes and

developed initial outlines for the whitepapers focusing on topics of interest. Teaming up into four author groupings, the cities and knowledge partners developed four outlines of whitepapers. Refined and revised outlines were then developed into draft whitepapers that underwent several iterations for development and finalization, ensuring that each paper delivers a set of concrete and targeted policy recommendations that address the different U20 stakeholders.

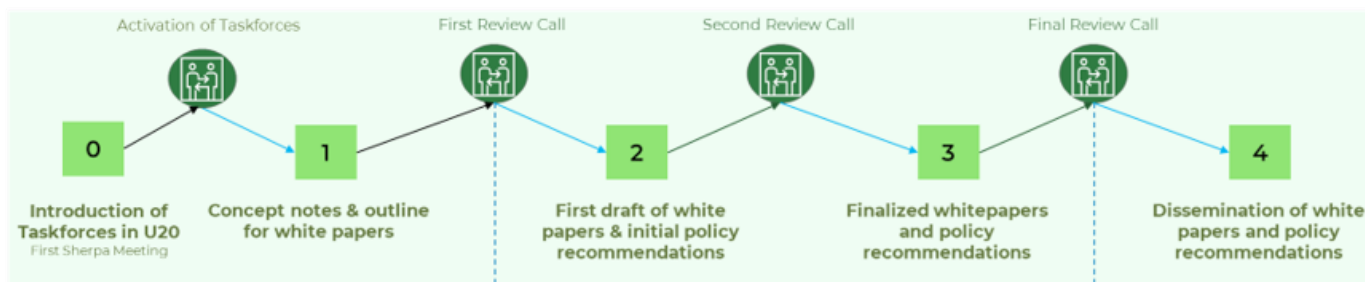


The four whitepapers under task force 1 (listed below) started with the exploration of the concepts of circular economy across different sectors, with the other three papers zooming into the concepts of circular economy in energy, mobility and buildings sectors :

1. The Post-COVID-19 Circular Economy: Transitioning to Sustainable Consumption and Production in Cities and Regions

2. Efficiency and Diversification: A Framework for Sustainably Transitioning to a Carbon-neutral Economy
3. Reshaping Mobility in Cities for a Carbon-neutral Future
4. Carbon-neutral Buildings and Recycled Materials : How Cities Want to Solve the Challenge

Taskforce Activities



U20 Communiqué



Legend

Key outputs of the taskforces

Milestones of the communiqué process

Taskforce Meetings

Feedback from review sessions to guide the output

Progress outputs to be reviewed during session

Alignment between taskforce output & communiqué

Along the taskforces timeline of activities, three review meetings were held where co/chairs and lead knowledge partners presented and discussed with the U20 Executive Team the progress and findings of the taskforces they represent, leading to the U20 Second Sherpa meeting that took

place during the first week of July. Parallel to the taskforces activities, the first draft of the U20 communiqué was developed by the U20 Executive team incorporating recommendations presented at the third (and final) review meeting.



About the Circular, Carbon-neutral Economy Taskforce

Meeting the global climate targets requires transforming our urban energy systems to be more efficient and based on clean renewable energy sources, while also shifting from a linear material economy to a circular model that reduces, reuses, recovers and recycles scarce and carbon intensive resources

De-carbonization measures in cities such as building retrofitting for energy efficiency, provision of sustainable mobility of people and urban freight based on public transportation and vehicle electrification coupled with the expansion of renewable energy sources could deliver over half

of the emission reductions needed to keep global temperature rise below 1.5 degrees Celsius. City planning and management approaches can greatly encourage Carbon-neutral lifestyles, through neighborhood walkability and cycling infrastructure, reorganization of food production and distribution for local and organic produce, or support programs for green technology and investment. Greenhouse gas emissions from material processes such as infrastructure construction, industry, and household waste need to be taken into account in a full life cycle approach. Cities need to reduce the use of carbon intensive and otherwise scarce materials, reuse urban infrastructure and consumer products to extend their lifespan, recover carbon intensive or otherwise scarce material from household waste, industry and physical infrastructure and recycle all materials from plastic to steel, from organics to rare earth materials in a circular economy model that decouples economic growth from carbon emissions.



15 cities

U20 Participating cities

Buenos Aires	Riyadh
Guangzhou	Sao Paulo
Madrid	Strasbourg
Mexico city	Tokyo
Rio de Janeiro	

Co-chair cities

Rome
Tshwane

U20 Observer cities

Amman
Dammam
Helsinki
Singapore



13 knowledge partners

Knowledge partners

- Cities Climate Finance Leadership Alliance
- Inter-American Development Bank
- King Abdullah Petroleum Studies and Research Center
- National Institute of Urban Affairs
- Université Nationale Gustave Eiffel
- Center for the Implementation of Public Policies for Equity and Growth
- International Finance Corporation
- World Economic Forum
- University of Pennsylvania, Institute for Urban Research
- World Wildlife Fund
- Coalition of Urban Transitions
- International Association of Public Transport

Lead knowledge partner

OECD



About the Authors & About the Contributors



Acknowledgement Note

The U20 Chair, Riyadh, would like to thank all authors and contributors for sharing their knowledge and experience on this topic; the cochair cities, Rome and Tshwane, for their guidance; and the lead knowledge partner, OECD, for their support in the development of this whitepaper.

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Yousef holds a Master's in Civil Engineering with more than 33 years of experience in strategic environmental management and protection (several fields), sustainability, Information Technology and Geographic Information System (GIS), spending the all of his professional career with Royal Commission for Riyadh City (RCRC).

Yousef had PMP certification and managed several iconic projects in the Kingdom such as Riyadh GeoEnv Explorer web Application for Wadi Hanifa & Riyadh Environmental Database and has developed expertise in environmental studies, monitoring and environmental information systems. He has also worked extensively on the formulation of policies, strategies, guidelines and codes for environmental planning, sustainable green buildings, building codes, material standards and other related fields at a national level. Yousef has been active member and effective contributor in several governmental and private technical committees within KSA and GCC, ones dealing with environmental management, project management, green building, sustainability, air quality, waste, water management, groundwater.



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Disclaimer Note

The views, opinions, positions and recommendations expressed in this White Paper are developed under the chairmanship of the City of Riyadh as U20 Chair City 2020 and are those of the authors and contributors, including contributing U20 cities and partners. They do not necessarily represent the views of all the U20 cities or any of its chairs, conveners, and partners. Many of the references in this White Paper will direct the reader to sites operated by third parties. Neither the institutions nor the authors of this White Paper have reviewed all the information on these sites or the accuracy or reliability of any information, data, opinions, advice or statements on these sites.



Executive Summary



Executive Summary

The global transportation industry has \$10 trillion in annual revenues and is responsible for about 23 percent percent of global CO₂ emissions—mainly in cities. If it were a country, it would be the third largest economy in the world, behind only the US and China. Its greenhouse gas impact drives home the urgent need for a transition to a zero-carbon mobility system. The U20 cities recommend that the G20 commit to such a transition.

Today's cities, the locus of the transportation industry, struggle to meet multiple challenges ranging from satisfying steadily increasing mobility

demands to addressing climate change, urban sprawl, and transportation-related health issues. To overcome these problems and become more livable requires a fundamental rethinking of the paradigm guiding urban mobility. Inspired by the principles of sustainability, cities can deploy an approach, known as the A-S-I framework, to develop a successful transport strategy. It incorporates three concepts: Avoid (reduce or avoid need to travel), Shift (shift to more environmentally friendly modes), and Improve (improve energy efficiency of vehicles). They offer a coherent comprehensive means to structure action plans and reform policies.



Background



Background

This paper builds on past G20 experience and the current G20 Presidency's priorities. The G20 member countries have acknowledged the urgency to enable and facilitate the transition to a decarbonized mobility system. The support to reshape mobility has been emphasized by metropolises for the past two U20 convenings, as evidenced through the two respective city leaders' communique. In both Tokyo's¹ and Buenos Aires'² communique, there were significant recommendations towards a transition to zero-carbon mobility. This paper also builds on the priorities of the G20 Presidency this year,

specifically, "Safeguarding the planet" when it comes to managing emissions for Sustainable Development. Another priority this paper tackles is "Shaping new frontiers," specifically through harnessing new technologies to maintain equity in mobility provision to people, and to offer innovative digitally enabled mobility solutions. The U20 is in full alignment with the 2020 G20's agenda and explores practical solutions for urban smart mobility, based on good practices and sharing of experiences in establishing and developing smart cities.

¹ Tokyo U20 Communique

- Promote research, development and collaboration with suppliers, fleet operators and businesses in order to expedite the transition to zero-emission vehicles and support cities' efforts to diffuse such vehicles through emissions standards, incentive schemes, and charging infrastructure roll out,
- Accelerate the transition to green and healthy streets through the promotion of sustainable public mobility concepts and corporate mobility management, people-friendly planning policies, increased rates of walking, cycling and use of public and shared transport.

² Buenos Aires U20 Communique

- Support city commitments to build resilience and achieve an inclusive and equitable low-carbon transition by advancing zero-carbon buildings, zero-waste, and green and healthy streets in urban areas by lending political support, resources and capacity, specifically for those cities disproportionately affected by the impacts of climate change.
- Ensure that cities have the funding and power to secure access to safe, genuinely affordable housing near community services including clean, efficient and comfortable public transportation, education, and healthcare, in diverse, culturally-vibrant neighborhoods where new and long-established residents can live together as neighbors



Introduction



Introduction

As cities grow in size and population, they play a pivotal role in the global economy. Being creative and innovative hubs of growth, cities are at the heart of a transition towards a carbon-neutral economy. The principles of circular economy can be translated and applied into urban systems where transformations and long-term, significant impacts can be made. One of the urban systems of highest priority to decarbonize is mobility.

The global transportation industry is responsible for about 23 percent percent of global CO₂ emissions and has an annual revenue of 10 Trillion USD; if it were a country, it would be the third largest economy in the world, behind only the US and China. The transportation industry is undergoing significant changes, brought by a confluence of social, demographic, political, financial, and technological forces.

The future of infrastructure has been among the recurring themes of the G20 since 2008. With proper management and serious action taken to tackle urbanization, a successful and rapid transition to green infrastructure is possible.

In fact, the Global Sustainable Development Report 2019 (European Parliament, 2019) highlights that SDG 11 on sustainable cities and communities is closely interlinked—and directly affects—several other SDGs, specifically SDG13 on climate change, SDG 14 on Life under water, and SDG 15 on Life on Land. It indirectly affects other SDGs on zero hunger, clean water and sanitation, and affordable and clean energy (SDG 2, SDG 6 and SDG 7 respectively) (UNESCAP).

Due to the urgency of a transition to zero-carbon mobility, U20 cities have reaffirmed in their recommendations to the G20 the necessity of supporting city commitments to build resilience and achieve an inclusive, equitable, low-carbon transition to zero-carbon mobility.

With the COVID-19 pandemic, there are significant implications on how people and goods move. This is a pivotal moment for the future of transport and to advance carbon-neutral mobility. A new paradigm is required, not only to reverse climate effects but also to ensure public health and national safety while at the same time maintaining efficient levels of mobility services to uphold socio-cultural cohesion and access to opportunity.

This paper aims to support Saudi Arabia's G20 2020 recommendations on the Circular, Carbon-neutral Economy by presenting the experiences of Buenos Aires, Riyadh, Rio de Janeiro, Tshwane, Lund, and Rome on the implementation of exemplary zero-carbon mobility policies.

This paper explores the urban role towards reshaping mobility towards a sustainable urban transport by highlighting some of the challenges faced by cities and opportunities to capitalize on innovative design, business models, and technology. The paper wraps up by presenting recommendations for strengthened actions towards a carbon-neutral mobility system.



Challenges Faced by Cities



Challenges Faced by Cities

Cities today are challenged with meeting steadily increasing mobility demands. Providing additional road space or privately owned vehicles have only worsened the pressing problems of traffic congestion, air quality deterioration and greenhouse gas (GHG) emissions in cities. This section explores a range of challenges that cities need to overcome to become more livable, and to offer human-centered mobility systems.

Climate Change

Cities are both the problem and the solution to Climate Change. According to UN data, cities account for 75 percent of global carbon emissions, but today they are also leading the battle against its negative effects.

The impact of climate change has been felt in cities around the world, and intensifying at an alarming rate. Recently, cities have witnessed extreme weather and events: heat waves, floods, hurricanes, and viral diseases such as dengue. These incidences have multiplied by 30 globally over the past 50 years, in part as a consequence of warmer global temperatures (Ebi & Nealon, 2016). Driven by climate change, changes in temperature, humidity, and precipitation risk damaging infrastructure in cities as well as disrupting and delaying global and local supply chains, which poses major economic impacts (UNCTAD, 2019).

Climate action is supported by both the scientific community and policymakers. Adapting to and mitigating the effects of climate change requires concerted effort by local and national governments all over the world. Cities have the

capacity to develop ambitious and innovative policies to reduce the amount of emissions in the atmosphere from mobility and other urban systems. The adoption of more efficient and cleaner urban systems, as well as the transition to a circular economy are key to alleviate the risks posed to cities by climate change, especially as it relates to transportation routes and the economic cycle in urban ecosystems.

Urban Sprawl

To cope with the ever-increasing need for space to accommodate economic growth and activities, cities have been growing rapidly for decades. This together with motorization led to low density and sparse settlements in many urban regions, often termed urban sprawl. Although such expansion of cities was a convenient solution, it was not an efficient development and came with many challenges for cities and public authorities.

Urban sprawls are often associated with high per capita energy consumption, traffic congestion and pollution, less housing affordability, and equity issues. Public costs are also significantly higher in low density development. Infrastructure for water, sewer, and transport costs more to build and maintain at low densities.

Issues, ranging from demographic, economic, environmental, and decisional aspects, arise from this spatial process that can take different forms depending on the specifics of an area. Urban planners and researchers focus their attention on urban sprawl to tackle its undesirable effects and to ensure sustainable urban development.



Challenges Faced by Cities

One of the main aspects to be considered to mitigate urban sprawl's effects is transportation. As the distance between the functional urban areas rapidly increases, the local authorities have difficulty keeping pace with the rhythm of urban expansion. Planning transportation is essential to ensure a sustainable development of the networks and to reduce its adverse impact on the environment and society. Transit Oriented Development (better known by its acronym TOD) is often proposed by urban researchers and planners and implemented in many urban contexts.

Exposure to Pollution

According to the UN report Measuring Progress (2019), in 2016, approximately 7 million deaths were caused by air pollution. Peer reviewed research (March 2019) by Max Planck Institute estimates deaths from outdoor air pollution—and resulting respiratory and cardiovascular diseases—to be as high as 8.8 million annually. By comparison, the World Health Organization (WHO) estimates the premature mortality rate from smoking tobacco (including passive smoking) to be 7.2 million people per year. Consequently, ambient air pollution poses a risk that is similar to smoking. According to WHO, over 90 percent of urban residents are exposed to polluted air, with traffic emissions the largest single source of that pollution.

Exposure to air pollution also increases the death rate of new COVID-19 patients; a recent study from Harvard University (April, 2020) found consistent results that an increase of 1 $\mu\text{g}/\text{m}^3$ in PM2.5 is associated with a 15 percent increase in the COVID-19 death rate. The risk of death by Covid-19 is enlarged by pre-existing health conditions, many of which are the same diseases affected by long-term exposure to air pollution, such as pneumonia and influenza.

Traffic Crashes

Every year, 1.2 million die on the world's roads, with millions more withstanding serious injuries and living with long-term health consequences. According to the World Health Organisation (WHO), road traffic injuries in 2017 are the ninth leading cause of death and are expected to become the seventh leading cause of death by 2030.

Traffic crashes burden health, insurance, and legal systems and incur huge economic costs at a local and national level. Besides the economic impact, road accidents can have social implications on local communities, specifically families of those involved in a crash.



Challenges Faced by Cities

According to the World Health Organisation (WHO), road traffic accidents can cause a loss of up to 3 percent of the global GDP, and up to 5 percent of GDP for low and middle-income countries. As more and more countries realize this, improving road safety is becoming a higher global priority. Local governments may need to focus more attention in the development of infrastructure, policies, and enforcement measures as a way to reduce the number of privately-owned vehicles and instead shift to the use of public transport, walking, and biking.

Physical and Mental Wellbeing

Transport can have direct and indirect effects on public health. Some of the positive effects of transport on public health includes improving access to healthcare facilities, employment, and education opportunities, as well as recreation and exercise centers. However, transport can be health damaging when there is inequitable access to health services, for example, as well as health consequences due to accidents, noise, and air pollution. A study by Michelle et al (2011,2014) suggests that motorized transport has more health damaging effects than health promoting effects. For instance, the increase in vehicle use promotes sedentary lifestyles, increased body weight, and—in extreme cases—obesity and other chronic diseases. Time spent in congestion and road traffic can induce stress and other physical and mental issues such as sleep disturbance, hypertension, and cardiovascular diseases.

In terms of policy and planning, cities have a responsibility to introduce reforms to support public fitness and health, for instance, policies to increase use of public transport, cycling, and walking rather than the use of private vehicles. Transportation strategies that target physical and mental wellbeing can focus on traffic calming and speed control, transport pricing reforms, streets designed for people rather than for cars, and smart growth development policies (Litman, 2013).

With the recent outbreak of COVID-19 and the subsequent restrictions on transport, cities have been challenged to maintain essential transport, especially the transport of medical supplies and other essential goods. Many transportation authorities have partnered with local health systems to provide for individuals and families requiring essential goods. During these unprecedented times, cities must reimagine transport and demonstrate the capacity to change the traditional forms of mobility to ensure people's needs are met and that they have access to opportunity and safe movement of goods, and to render cities more resilient. The later also presents an opportunity for cities to accelerate transition to zero-carbon mobility. COVID-19 struck cities may be able to build back better structures, amplifying and supporting growing demands for safer transport options such as e-biking, biking, and walking.



Approach to Sustainable Urban Transport



Approach to Sustainable Urban Transport

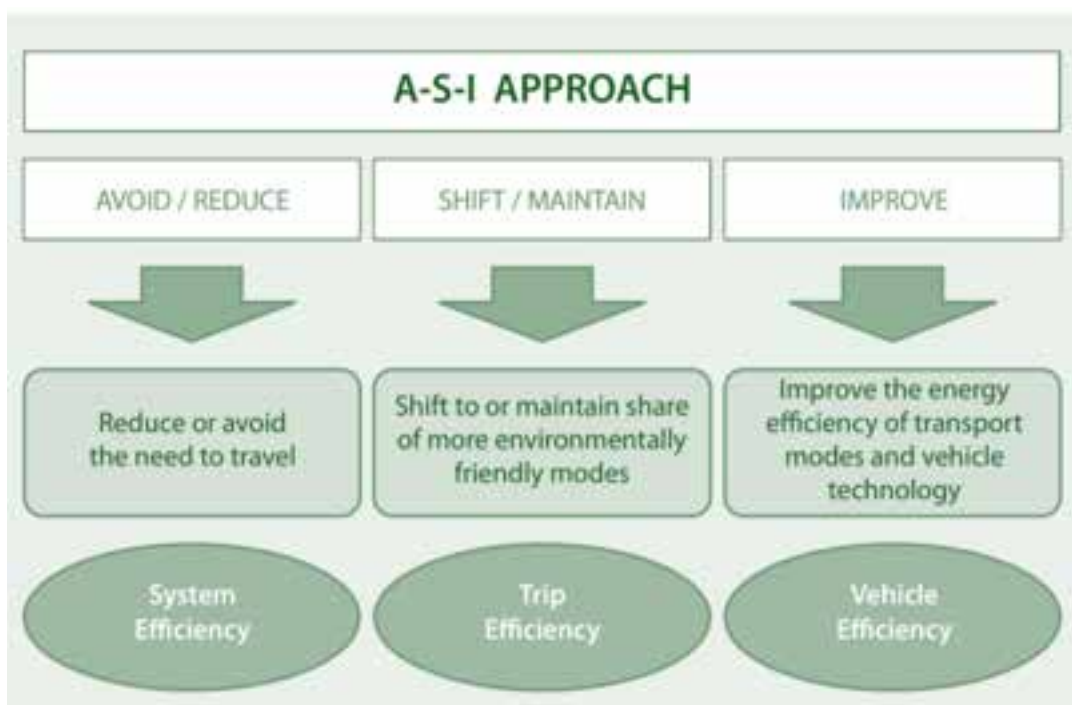
For a sustainable urban transport, cities require a fundamental rethinking of the paradigm by which mobility is guided. Inspired by the principles of sustainability, cities can deploy an approach, known as A-S-I, for a successful transport strategy. The A-S-I framework of Avoid, Shift, and Improve presents a coherent comprehensive framework to structure action plans and reform policies.

The three pillars of the framework are described as follows below:

- **Avoid:** the need to improve the efficiency of the transport system as a whole.
- **Shift:** seeks to improve individual trip efficiency.
- **Improve:** focuses on vehicle and fuel efficiency as well as on the optimization of the operational efficiency of public transport.

Figure 1.

The three-pillar approach towards sustainable urban transport



Source: GIZ sourcebook at <https://www.sutp.org>

An aerial photograph of a city, likely San Francisco, with a prominent bridge (Golden Gate Bridge) visible in the background. The image is overlaid with a dark green gradient and a bright green curved shape on the left side.

Opportunities for Cities to Harness



Opportunities for Cities to Harness

For sustainable urban infrastructure, cities may deploy the A-S-I approach while harnessing the latest opportunities and advancements in mobility relating to systems, nature of trips, and vehicles. While what works for one city may not work for the other, some valuable lessons can be learned from the experiences of U20 cities in deploying one or more pillars of A-S-I.

Avoid-System Efficiency

To avoid travel, the efficiency of the transport system and city design as a whole shall be improved to reduce the need to travel. This can be achieved through compact, mixed-use, transport-oriented development of cities.

Transit Oriented Development (TOD) involves creating concentrated nodes of moderate-to-high density developments supporting a balanced mix of land uses around transit stations. TOD encourages compact growth within a 5-10 minute walk from quick and efficient public transit and promotes 'live, work, play, shop, and learn' in a pedestrian-friendly environment—without need of a car. As residential, work, and leisure districts become more closely connected, the need for motorized travel and trip length can be substantially reduced.

At the core of a TOD is to bring energy efficiency. The important benefits of TOD include increased number of transit ridership, reduced traffic congestion and pollution, and more walkable, livable neighborhoods. It also promotes equity through a mix of affordable and market-rate housing, which may in turn reduce income

segregation and provide disadvantaged residents with opportunities to move up the occupational and social ladders.

Many cities are implementing TOD, especially in the United States where most cities are low density development. TOD can bring significant economic and environmental benefits to those cities. Urban regions such as New Jersey, San Francisco, and Pittsburgh are focused on TOD to reduce economic, social, and environmental cost. A high-density development is energy efficient and economically sustainable. For example, Atlanta and Barcelona have about the same population (3.8 million). Whereas Barcelona needs only 99 km of metro line to provide access to 60 percent of its population, Atlanta would need 3400 km of metro line for the same accessibility.

Although the core concept of TOD is density and is a concept more applicable to urban sprawl and low-density development like in the USA, it is very much applicable to European context of high-density developments as well. Many European cities are suffering from excessive automobility and insufficient transit ridership. TOD is not only a high-density development but also an integration between transport and land-use. Therefore, many European cities are applying the concept to cope with challenges such as climate change, pollution, and congestion as well as transit use and survival of the public transport system. In different contexts, TOD faces different challenges, and public authorities have to tackle those for the success of TOD.



Opportunities for Cities to Harness

TOD Guidelines in Riyadh for a Transit-Oriented City

Riyadh is undergoing urban sprawl at one of the fastest rates in the world; the rate of sprawl is greater than the rate of economic growth. In line with Saudi Arabia's commitment to the Paris Agreement, Riyadh is introducing energy efficient measures in buildings and transportation and applying adaptive strategies. Substantial investment has been made to the development of the new Riyadh Metro, giving Riyadh the perfect opportunity to transform into an efficient transit-oriented city. With the integration of the public transport system within Riyadh, the city aspires to provide economic, social, and environmental benefits for local neighborhoods.

In line with these aspirations, the Royal Commission for Riyadh City (RCRC) created a strategy for the design, implementation, and delivery of Transit Oriented Design (TOD) projects across the city. The TOD Urban Design Guidelines for Riyadh set out the city's expectations with high level guiding principles for development around transit stations, integrating transit, and land-use. These will be used by RCRC, government departments, landowners, and developers to facilitate collaborative discussions, assess TOD opportunities and potential for rezoning, and review planning proposals.

Shift-Trip Efficiency

The second pillar seeks to improve individual trip efficiency through modal shifts. Most of the aforementioned challenges of a transport system should be addressed through a modal shift from the most polluting modes of urban transport (i.e. cars and other privately-owned vehicles) towards more environmentally friendly modes.

It is essential to shift towards, and maintain, environmentally friendly modes of transport within cities, which are (1) active transport: Walking and cycling—representing the most effective and environmentally friendly options towards realizing sustainable mobility, (2) public transport: bus, rail, metro networks, etc. which provide accessible and affordable transportation options for all, decrease the reliance on personal vehicles, and thus potentially reduce congestion and negative

environmental impacts. While public transport may also generate greenhouse gas emissions, the higher occupancy levels render the associated emissions per passenger-km lower than those compared to privately-owned vehicles.

Globally, as much as three-quarters of road transport consists of short trips in and around cities. This indicates considerable potential in cities to drive modal shift from individual car rides to public transport and non-motorized transport. The One Planet Mobility City project, run in collaboration between WWF and cities of Malmö, Sofia, Freiburg and Barcelona, concluded that three mutually supportive approaches were important to support modal shift:

- **Pull measures**, making the use of public or non-motorized transport (cycling, walking) more attractive. Specific measures are: Increasing the



Opportunities for Cities to Harness

- density, speed, and comfort of the public transit network; reducing fares; extension of bicycle lanes, bicycle parking stands, and reduction of barriers to pedestrians and cyclists.
- **Push measures**, rendering the use of the private car or motorized vehicle less attractive. The spectrum of push measures reaches from reduction of street capacity (in favor of separate lanes for buses or bicycles) or speed limitation to 30km/h, to a progressive pricing of parking facilities or introduction of road charges.
- **Land-use policies**, decreasing the demand of driven kilometers by controlling the urban topology and utilization of urban space. Densification and mixed-use policies aim at distributing places for living, working, shopping, and leisure in a homogeneous fashion such that the city becomes largely self-contained in its facilities on a district level, and the need to travel long distances is reduced.

Strategic Planning and Regulatory Instruments in Rio de Janeiro

Rio De Janeiro has utilized strategic planning and regulatory instruments to shift modal shares and to accelerate their transition to a carbon-neutral mobility system. Mayor Marcelo Crivella signed in June 2019, Rio Decree Number 46081, aiming to transition city streets to “carbon-free” environments. The decree aimed to reduce the number of polluting vehicles on city roads and increase walking rates, bicycle sharing, and other public transport accessible to all citizens. The city started with the replacement of fossil fuel-powered vehicle technology used in the municipal transport system with zero emission vehicles.

Based on Rio de Janeiro’s Climate Action Plan, this decree is part of a wider policy of managing emissions towards sustainable development. Rio’s Climate Action Plan, created by the municipal government in partnership with C40, establishes the goal of achieving carbon emissions neutrality by 2050. In turn, this plan is a component of the City for Climate Program, which provides a monitoring strategy for the city’s greenhouse gas emissions and conceives a governance structure at City Hall engaged and committed not only to climate change issues, but also to sustainable development. The City for Climate Program is incorporated into Rio de Janeiro’s Sustainable Development Plan, localizing the Sustainable Development Goals (SDGs) set by the United Nations Agenda for 2030 into the city’s policies, strategies, and short-term plans.

To engage citizens with the city’s long-term planning, Rio de Janeiro’s Sustainable Development Plan, planned to be launched by the end of 2020, is being designed with the participation of citizens. Through community committees and via an online platform named “participa.rio”, the platform is a successful example of an interactive method, empowering citizens on sustainable development issues.



Opportunities for Cities to Harness

Active and Public Transport in Buenos Aires

For over a decade, the City of Buenos Aires has been developing a Sustainable Mobility Plan oriented around reducing private vehicle use and GHG emissions, while contributing to citizens' health and wellbeing. Ensuring their quality of life is at the core of government policy.

In 2009, Buenos Aires began encouraging mass use of bicycles. Bike lanes and paths were built to connect the entire city. Furthermore, Buenos Aires has set up a system of free public bicycles called Ecobici (Eco Bikes). Likewise, 259 blocks of the city's downtown area are now pedestrian priority zones.

Buenos Aires built an extensive network of Metrobuses to enhance efficiency of public transport and reduce travel times. The Metrobus is a transport system that combines traditional and articulated buses with exclusive lanes. Its implementation has improved interaction with transit systems and brought about a safer, more comfortable, and more environmentally friendly travel experience. Furthermore, Buenos Aires has 6 metro lines, which are used by more than 1.3 million passengers daily. In order to improve the service's quality, the city committed to reducing the average time between peak hour trains to three minutes.

In the context of the lockdown of the city due to the global COVID-19 pandemic, Buenos Aires has adopted special measures to avoid the spread of the disease on public transit and protect the great number of citizens that commute daily into the city by bus, metro, and train. As the city gradually switches back on, new policies are being introduced to further promote the use of the public bicycles, avoid crowding in public transport, expand spaces for pedestrians on roads, and reduce vehicle traffic by closing certain streets and avenues.



Opportunities for Cities to Harness

Public Transportation as a Foundation in Riyadh

The city of Riyadh initiated transportation transformation through the \$23 billion King Abdulaziz project for Riyadh Public Transport Project (RPTP)—one of the most exciting projects in the reimagination of the capital. The project converts an underdeveloped and unpopular public transportation sector in Riyadh into a groundbreaking network that includes 6 metro lines, 3 Bus Rapid Transit (BRT) lines, and a 1900 Km of community and feeder buses network.

The RPTP features metro rail and bus rapid transport designed based on latest technologies, leapfrogging development with the integration of technologies such as driverless trains and buses on demand within the system. The project is expected to reduce 2.2 million car trips from roads daily and 803 million car trips annually, equivalent to 1.4 million tons in carbon reduction annually. In addition, the Riyadh metro stations are certified by the US Green Building Council, and buses adhere to the Euro 5 standards to achieve a reduced carbon footprint.

While Riyadh faces challenges to shift to active transportation, especially with the hot summer months when pedestrians or bikers may feel uncomfortable walking or biking, certain design considerations can be accounted for to ensure consistent levels of ridership throughout the year. Design elements such as arcades, shade-ways, evaporative cooling, temperature-controlled transition spaces, or connecting development through the use of retail or other complimentary uses, can all serve to extend the distances people will be willing to walk to access transit.



Opportunities for Cities to Harness

Rome Sustainable Urban Mobility Plan (SUMP) and Actions Towards Zero Emissions in Mobility

The Municipal Assembly of Rome adopted on August 2, 2019 the SUMP - Sustainable Urban Mobility Plan, which is a strategic plan that defines and develops infrastructures for mobility services on a medium-term basis (10 years). It promotes safety, accessibility for all, and implements smart technologies toward a connected vehicle-infrastructure-pedestrian environment and intelligent transportation system. The urban transport system has been designed to:

- **Guarantee** all citizens transport options to access key destinations and services;
- **Improve** safety conditions;
- **Reduce** air and noise pollution, greenhouse gas emissions, and energy consumption;
- **Increase** the efficiency of transport flows of people and goods.

With a 9 Billion Euro investment in public transport infrastructures within the next 10 years, the city will expand its metro and tramway lines and intermediate systems, with a complete renewal of the public transport surface fleets towards low emission and zero-emission vehicles within 2030. The city initiated the process of renewal of vehicles in 2019.

The SUMP demonstrates the attempts of the City Administration (CA) to encourage public and private cooperation in mobility. The city administration provides incentives for the purchase of low environmental impact vehicles, and starting next year the city will offer an increased freight stalls.



Opportunities for Cities to Harness

Biking in Lund Towards a Transition for a Healthy and Sustainable Infrastructure

Lund, a small university town nearby the cities of Malmö and Copenhagen, received an award in 2018 for the best support for biking in Sweden and was one of the finalists in the One Planet City Challenge in Sweden in 2018. The city broke national records being the community with most bikes per capita in Sweden. The city also has 260 km of high-quality bicycle paths, and a high percentage of bike users; in fact, 14 percent of all trips in Lund are made on foot, 27 percent by bicycle, and 24 percent by public transport. A total of 186,000 km is biked every day in the city of Lund.

The sustainable transition of the city of Lund comes at the back of its master plan called LundaMaTs (WWF). In short, the plan aims to enable sustainable mobility and increase quality of life by altering infrastructure and urban planning. The city of Lund encourages sustainable behavior by designing a network of buses, bike paths, parks, and urban greenery. The city provides what is called “bike-kitchens,” basically the space and tools to repair citizens’ bikes, nurturing sustainable behaviors. Active NGOs, such as Lund Society for Nature Conservation, also contributed not only by producing inventories of bike paths and maps, but also by challenging people’s mindsets and offering workshops, for instance on how to pack for family bike vacations.

Improve-Vehicle Efficiency

The third pillar, “improve,” focuses on vehicle and fuel efficiency as well as on the optimization of the operational efficiency of public transport. A key to attain vehicle efficiency is the improvement of the energy sources required for their operation; introducing renewable energy sources into the transport sector must become a basic principle for motorized transport. Another alternative in line with the aspiration to efficient and sustainable vehicles is to reimagine the operations of mobility to introduce and harness innovation in transport.

Harnessing the advancements in artificial intelligence and data analytics, different components of transportations have witnessed

a revolution. Some smart solutions applied in the urban scape have been around planning, designing and decision making, public transportation, and intelligent self-driving cars. Leveraging AI solutions can also help real-time incident detection and future traffic state prediction (Abduljabbar et al, 2019).

Another area where AI applications have witnessed leapfrog developments is the Intelligent Transport Systems (ITS). Capturing big data and integrating it together with machine learning, ITS alleviates congestion and improves the driving experience. For example, deep reinforcement learning has been used for real time optimization of traffic control policies embedded in large scale ITS systems (Liu, 2018).



Opportunities for Cities to Harness

The future mobility paradigm will consist of autonomous systems and powerful electric drivetrains across a wide variety of modes, most of which will be seamlessly shared, connected, safe, convenient, personalized, and on-demand. The four areas of innovation trending in transportation are:

- **Shared:** The mobility platform of the future will build on the idea of distributed and shared mobility. Fewer people will own cars and instead will opt to use on-demand services, enabling greater vehicle-use efficiency and less congestion
- **Multimodal:** The future of mobility will consist of a highly flexible platform comprising various modes of transportation, each providing a unique solution. Every leg of a journey will come with an array of transportation options accessible to all.
- **Electric:** The first electric car was built in 1832, and humanity has come a long way since then. Today, Electric Vehicles (EVs) have better power, speed, and safety compared with gas-powered cars, and they are better for the environment
- **Autonomy:** Although still in development, Autonomous Vehicle (AV) systems and hardware are heavily researched and have received more than \$10B of funding. Large automakers and tech giants are racing to build the first fully commercialized product. Cities like Tokyo, Phoenix, and Singapore have all successfully tested autonomous taxis, providing further accessible options to more population segments through this technological disruption.

With the rise of leading-edge technological services has come a new paradigm: Mobility as a Service (MaaS). Mobility as a Service goes far beyond getting a person from one place to another; rather, it is about understanding people's journey. MaaS integrates various forms of transportation, technology, and user adoption to create a seamless on-demand service that revolutionizes the way people get around and could shift an increasing amount of existing travel demand from personally owned vehicles to demand-responsive services.

Mobility-as-a-service (MaaS) in Riyadh

Riyadh aims to develop a fully integrated "mobility-as-a-service" (MaaS) application that combines public transit and other shared mobility services through a single user-centric interface, allowing users to plan and pay for a journey across Riyadh using multiple modes of transportation.



Opportunities for Cities to Harness

Rome and Mobility Innovation with Electric Cars

Roma Capitale aims to incentive innovations and sustainable behaviors by implementing the Electric Mobility Plan for the city. Activated by ENEL, National Entity for Electricity, with the coordination of Roma Capitale and the technical support of Roma Servizi per la Mobilità, there are currently 118 charging stations: for cars, motorbikes, and car sharing. By 2020, the total demand will be of 700 charging stations, integrated by fast recharge stations.

Multimodal Transportation in Rome After the COVID-19 Lockdown

The Rome Sustainable Urban Mobility Plan proposes the effective application of intermodality. The operation of this model requires the development of quality public transport solutions with dedicated corridors and tramways to ensure an internal tangential effect to favor the distribution of users—in a truly competitive manner—against private vehicles.

Post COVID-19, the Rome Administration includes actions to increase the active mobility as well as to better integrate them with Public Transport (PT). With the well-planned public transport infrastructure and short distances in city centers, the combination of different transport modes would render the urban transport system resilient against health risks, efficient, and matching individual needs in terms of time, cost, and quality—ensuring social inclusivity and sustainability.

In April 2020, Rome approved new guidelines on “free floating” rental services of scooters, mainly electric, thus encouraging shared mobility systems in view of the partial reopening of city activities after the Covid-19 emergency. In May of the same year, the city also approved plans to develop temporary cycle paths, encouraging active and sustainable mobility.

As the city plans to reopen, Rome is enforcing safety measures and social distancing measures on public transport with measures such as cleaning and disinfecting public transport vehicles, providing personnel with protective equipment, monitoring and reducing capacity for trips—to name a few. But, these measures impose challenges on the city, reducing ability to generate revenues and increasing the costs of operating public transport.



Opportunities for Cities to Harness

Public Procurement for Sustainable Vehicles in Rio de Janeiro

As a concrete measure endorsed by the aforementioned decree, regarding the reduction of the carbon the municipal public transport system, it was determined that any concession/permission contract for the delegation of public passenger transport service carried out by buses as of January 1, 2025, can only be concluded under the contractual provision for the use of zero-emission vehicles.

With the same purpose, the Municipal Urban Cleaning Company, Comlurb, is gradually replacing its waste truck fleet from fossil fuel engines to electric ones. Comlurb delivered in September of 2019 the first nine 100 percent electric waste collection trucks. This fleet makes Rio de Janeiro the first city in the world, outside China, to have this type of environmentally sustainable vehicle. By the end of 2020, eleven more electric waste trucks will be delivered, totaling 20 vehicles, which will represent about 10 percent of the municipal waste fleet.

Low Emission Mobility Options in Buenos Aires

The City of Buenos Aires has been working together with the private sector to enhance this transformation. Electric and hybrid cars are now exempted from patent payments. Furthermore, the transition to low-emission electric buses has already started: In alliance with the National Government and the Development Bank of Latin America (CAF), the city launched a pilot program consisting of 8 buses with different charging systems.



A Future of Carbon-neutral Mobility in Cities



A Future of Carbon-neutral Mobility in Cities

Considering the damage caused by greenhouse gases to the health of the population, as well as its effects on climate change, and given that the transport sector is responsible for 23 percent of the global CO₂ emissions, cities are adopting infrastructural changes and new technologies in order to reach zero-carbon mobility.

The zero-carbon mobility future will start in cities. In such a future, urban transportation sectors will be enabled to contribute to national efforts in combating climate change and mitigating structural inequalities, while keeping to heart the sector's primary responsibility to promote the development of efficient integrated transport systems, enabling sustainable socio-economic development and improving the quality of life of urban populations. Cities will have engaged the low-carbon transition of the sector and aligned policies to promote energy efficiency

and emission control measures in all transport modes. Smarter public transport systems will be widespread in cities, with the transition to electric mobility completed, and connected and accessible infrastructure for pedestrians and cyclists in place for zero emissions transport. Cities will have facilitated the sector's just transition to climate resilient transport systems and infrastructure. The gap between the digital and physical worlds will have been bridged through a mobility ecosystem leveraging advances in fundamental hardware, artificial intelligence, and communications—accessible to all. Adverse effects of transport activities on the environment will have been minimized, and cities will have successfully promoted behavioral changes towards sustainable mobility alternatives through information, education, and awareness raising.



Recommendations



Recommendations

Overarching recommendations across ASI framework:

National governments may consider incorporating Avoid, Shift, and Improve strategies and policies which primarily focus on avoiding unnecessary transport, while shifting to low carbon modes and improving vehicle design, fuel efficiency, and energy sources.

For a shift towards a sustainable and accessible transport system, all stakeholders of the sector and beyond, from regional and local governments to UN organizations, multilateral and bilateral development organizations, NGOs and foundations, communities, planners, developers, academia, and the private sector should be involved in a multi-stakeholder participatory decision-making processes to accelerate the transition.

Local and national governments shall cooperate towards the implementation of advanced Intelligent Transport Systems while maintaining a human-centered design.

Local governments should support capability building to upskill mobility planners and practitioners in areas pertaining to the applications of Artificial Intelligence, big data, and analytics in mobility systems.

Avoid Trips-System Efficiency

- The national government should enable and promote transit-oriented development and develop jobs-housing balance policies.

- In conjunction with TODs, local governments can consider introducing New Urbanism. Introduce land use and zoning policies that minimize the demand of driven kilometers by controlling the urban topology and utilization of urban space. Introduce densification and mixed-use policies to distribute places for living, working, shopping, and leisure in a homogeneous fashion such that the city becomes largely self-contained in its facilities on a district level and to reduce the need to travel long distances.
- The national government should structure guidelines for transport land-use to account for multi-modal transit hubs, smart infrastructure for connected and autonomous vehicles, personal micro mobility, electric vehicle charging stations, and curbside management for shared mobility
- Local governments may promote strategies and standards for delivering transport infrastructure, integrated transit planning, and systems that build climate resilience in urban and rural communities, whilst minimizing the environmental impact of transport infrastructure and increasing access to opportunities for all.

³. Slocat



Recommendations

- Governments at national, regional, and local levels should align to develop best practice guidelines to ensure integrated, climate-friendly transport options are incorporated into land-use and spatial planning at all levels.
- Local governments should support and offer upgraded ecommerce capabilities with virtual online stores and promote building work environments in the public and private sector that support and enable employees to leverage latest digital tools to work from home, reducing the need for daily commutes.
- Cities and local governments should enable public-private sector corporation to provide incentives for the purchase of low environmental impact vehicles and offer an increased offer of freight stalls.
- National governments should shift national transport budgets from roadbuilding to public and active transport.
- National governments should provide cities access to federal financial mechanisms to support carbon-neutral mobility as these contributions support the achievement of the country's international commitments such as the Paris Agreement and the Sustainable Development Goals.

Shift Modes-Trip Efficiency

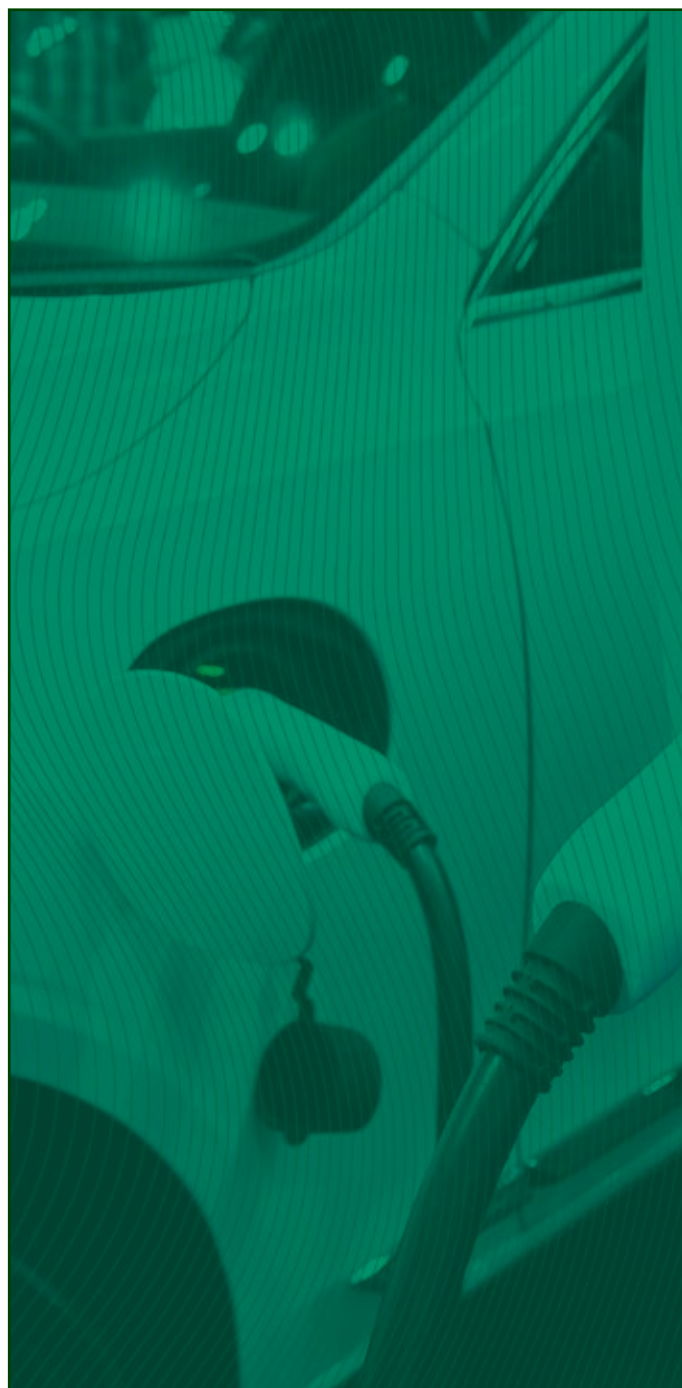
- Local governments can reimagine business models to support modal shifts, subsidizing development of public transport infrastructure, while providing incentives to induce habitual behavioral shifts for people to depend on public transport instead of owning private vehicles.
- Cities and local governments must evaluate policies to reduce the spread of infectious diseases on public transit and ensure safety conditions and social distancing on public transport.
- Local government should reduce the number of automobiles in cities by devising and implementing municipal policies to reduce automobiles in cities (congestion pricing, limited parking).
- Local government should rethink carbon-neutral possibilities: allocate cycling paths and footpaths, urban design, and streetscape to accommodate safety measures for pedestrians and cyclists.
- National governments should proactively manage the transition to zero-carbon resilient cities. Countries who fail to do so will be locked into high-carbon systems. These will become unprofitable or inoperable as markets and regulations evolve. The result will be stranded assets and stranded workers as industries fail or relocate.
- National governments can enable Future of Mobility programs, for example the adoption of Mobility as a Service (MaaS) helps reduce the number of vehicles, increase ridership, and lower number of trips but requires policy guidelines for public-private data sharing and an operating model that balances the strengths of both public and private operators leading to consistency in the direction of mobility service development.



Recommendations

Improve-Vehicle Efficiency

- Local governments should introduce Electric vehicles and autonomous cars and target conversion of public fleets to cleaner alternatives.
- Local governments may invest in sources of green energy's infrastructure, such as biogas filling stations, electric car charging points, GIS integrator ICT technology platforms for locating stations, regulating future pricing, and providing statistics.
- National governments should set up an enabling environment to improve vehicle efficiency:
 - Encourage development of clean technologies through the definition of emissions standards, promotion of tax incentives, and inducement for scientific research.
 - Reduce fossil fuel related emissions in the transport sector by promoting norms and standards for fuel economy and putting in place regulations that promote improved efficiency in fossil fuel powered vehicles and improved environmental performance of fossil fuels, while fully recognizing the urgency of shifting to a 100 percent renewable energy based transportation system pre-2050 (earlier for many nations).
 - Plan to eliminate transport sector fossil fuel subsidies and work to phase out internal combustion engines by the earliest date possible.
 - Address and promote behavior and lifestyle changes for the adoption of shared mobility services, clean transport, and lower reliance on vehicle ownership





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Appendices





TOD Guidelines in Riyadh for a Transit-Oriented City

Riyadh is one of the fastest growing cities in the world. The rate of sprawl is greater than the rate of economic growth. With a vision to develop a more economic and energy efficient city, public authorities are taking on many initiatives. As a step towards their Paris Agreement commitment, Riyadh is introducing energy efficient measures in buildings and transportation and applying adaptive strategies. In this regard, substantial investment has been made in the development of the Riyadh Metro. With the urban integration of the transport system within Riyadh, the city aspires to provide a wealth of economic, social, and environmental benefits for local areas and the city as a whole through the construction and delivery of the public transport network and associated public realm improvements.

In line with the aspirations for the public transport system, the Royal Commission for Riyadh City (RCRC) has identified the need to create a strategy for the design, implementation, and delivery of Transit Oriented Design (TOD) projects across the city. The project was divided into three different but interrelated phases starting with (1) preparation for an international TOD experience strategic principles, (2) functional classification of TODs and potential opportunities for the city of Riyadh and ending with (3) preparation of urban design guidelines.

The Transit Oriented Development (TOD) Urban Design Guidelines for Riyadh are intended to communicate the City's expectations through setting out guiding principles for development around transit stations. These will be used by RCRC, government departments, landowners, and developers in order to facilitate collaborative discussions and to assess TOD opportunities and rezoning potential, and review planning proposals through integration of transit and land use within station areas.

Strategic Planning and Regulatory Instruments in Rio de Janeiro

Rio De Janeiro has utilized strategic planning and regulatory instruments to shift modal share development and to accelerate the transition to a Carbon-neutral mobility system. Mayor Marcelo Crivella signed, in June of 2019, Rio Decree Number 46081, aiming at the transition from city streets to environments "Carbon-free", with a view to reducing the number of polluting vehicles on city roads, increasing walking rates and sharing bicycles and other means of public transport accessible to all citizens, starting by carrying out the replacement of the current vehicle technology used in the municipal transport system powered by fossil fuels for vehicles with zero emissions

Based on Rio de Janeiro's Climate Action Plan and on C40 Green and Healthy Streets Declaration, this decree is part of a wider policy of managing emissions towards sustainable development that includes, Rio's Climate Action Plan, the City for Climate Program and, ultimately, Rio de Janeiro's Sustainable Development Plan.

(Continue)



Strategic Planning and Regulatory Instruments in Rio de Janeiro

Rio's Climate Action Plan, created by the municipal government in partnership with C40, establishes the goal of achieving carbon emissions neutrality by 2050. In turn, this plan is a component of the City for Climate Program, which integrates the execution of projects with the main purpose of developing low carbon solutions. The Climate Program also provides a monitoring strategy for the city's greenhouse gas emissions and conceives a governance structure at City Hall engaged and committed not only to climate change issues but also to sustainable development.

Rio de Janeiro aspires to reduce the city's greenhouse gas emissions. To ensure that this policy is integrated into a broader context of sustainable cities, established by the 2030 UN Agenda, the municipality created a governance mechanism called City for Climate Program, which defines means of implementing and monitoring the guidelines and actions determined in Rio's Sustainable Development Plan within the scope of climate change.

Moreover, the City for Climate Program is incorporated into Rio de Janeiro's Sustainable Development Plan, localizing the Sustainable Development Goals (SDGs) set by the United Nations Agenda for 2030 into the city's policies, strategies, and short-term plans. Therefore, the City for Climate Program defines means of implementing and monitoring the guidelines and actions determined in Rio's Sustainable Development Plan within the scope of climate change.

To that end, the adhesion of zero-carbon mobility policies by the governments, in which one declares its commitments in promoting green and healthy streets, with planned actions to meet deadlines, as per the Rio Decree Number 46081, must be a major priority.

It is important to mention that Rio de Janeiro's Sustainable Development Plan, planned to be launched by the end of 2020, is being designed with the participation of citizens, through community committees and via an online platform named "participa.rio". This platform is a successful example of an interactive method applied to engage citizens with the city's long-term planning, as well as empower them on sustainable development subjects.

Active and Public Transport in Buenos Aires

For over a decade, the City of Buenos Aires has been developing a Sustainable Mobility Plan oriented around reducing private vehicle use and GHG emissions, while contributing to citizens' health and wellbeing. Ensuring their quality of life is at the core of government policy.

In 2009, Buenos Aires began encouraging mass use of bicycles. Bike lanes and paths were built to connect the entire city. Today, the network extends 250 kilometers and reaches 41 city neighborhoods. Furthermore, Buenos Aires has set up a system of free public bicycles called Ecobici (Eco Bikes), with 200 automatic stations and 2,000 bikes, operational 24/7.

(Continue)



Active and Public Transport in Buenos Aires

The number of residents opting for bikes as a means of transport is growing; since the new system was launched, over 600,000 users have signed up and over 6 million rides have been taken, amounting to 4 percent of all commutes in the city. Likewise, 259 blocks of the city's downtown area are now pedestrian priority zones. The Pedestrianization Plan has transformed some of the busiest places in the city into quieter, more accessible areas, with greater space for pedestrians. "Macroblocks" bordered by avenues were also created, with restrictions on the use of vehicles.

Recently, pedestrian-only access along Corrientes Avenue (one of the most symbolic in the city, comparable to the Gran Vía in Madrid or Broadway Avenue in New York) was enlarged. This area has the largest concentration of bookshops, theaters, pizza restaurants, and bars in Buenos Aires. Corrientes Avenue now has two exclusive lanes for public transport 24 hours a day, and as of 7 PM—the time when most people walk by to enjoy the nightlife—two other lanes are converted into pedestrian lanes.

Latin America registers the highest per capita bus use in the world (O'Connor & Viscidi, 2017). To make this means of public transport more efficient and reduce travel times, Buenos Aires built an extensive network of Metrobuses. The Metrobus is a transport system that combines traditional and articulated buses with exclusive lanes. Its implementation has improved interaction with transit systems and brought about a safer, more comfortable, and more environmentally friendly travel experience. The city's Metrobus network extends over 62,5 kilometers, has cut around 50 percent of travel time, and benefits over 1.4 million users every day. Moreover, Buenos Aires has installed 328 solar panels in the Metrobus stations located along 9 de Julio Avenue, one of the main transit arteries in the city, which are also helping to raise awareness about clean energies.

Buenos Aires has 6 metro lines, which are used by more than 1.3 million passengers daily. In order to improve the service's quality, the city committed to reducing the average time between peak hour trains to three minutes. This goal has already been reached for 5 of the 6 lines. In addition, in the last 4 years, 474 air-conditioned trains were incorporated into the metro network and 7 new stations were inaugurated, facilitating more access to public transport.

In the context of the lockdown of the city due to the global COVID-19 pandemic, Buenos Aires has adopted special measures to avoid the spread of the disease on public transit and protect the great number of citizens that commute daily into the city by bus, metro, and train.

Minimal public transport services with reduced standardized timetables have been maintained; all public transport is subject to rigorous cleaning and disinfection. Mass public information campaigns on personal hygiene and recommendations to avoid public transport where possible have been carried out.

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Active and Public Transport in Buenos Aires

Social distancing markings between seats are set out on public transport; commuters and transport staff must wear masks at all times, and health controls are in place at busy junctions. The main Constitution station uses thermal cameras to measure passenger temperatures.

For private vehicles, as for any individual seeking to leave their house, permits available by request online are required to move around the city. There are 400 vehicle controls in the city, with 23 exclusive access lanes reserved for public transport, logistical transport, and medical staff.

As the city gradually switches back on, new policies on urban mobility are being put in place, alongside interventions in the public space.

Cities all over the world are experiencing a growing need to quickly readjust public spaces and promote mobility that allows citizens to return to their daily activities while ensuring social distancing. Indeed, new spatiality and sustainable mobility are arising as two major features of the new normal in urban centers worldwide.

For years, the City of Buenos Aires has been developing a series of measures aimed at turning it into a city on a human scale. That is, a city made for its residents, that seeks to improve their quality of life by means of enhancing coexistence in public spaces that are accessible, safe, and enjoyable.

In the post-pandemic reopening context, policies on a human scale are key to helping Buenos Aires' residents adapt to a new reality, one where daily life is concentrated more and more within neighborhoods: people shop at local groceries and engage in open air leisure activities just a few meters from their homes.

In addition to further promoting the use of the public system of bicycles, approximately 100,000 square meters of the city have been pedestrianized, spaces for pedestrians on roads have been expanded, and vehicle traffic reduced by closing certain streets and avenues. These initiatives contribute to promoting sustainable mobility while ensuring social distancing, avoiding crowding in public transport, and encouraging local trade.

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Rome Sustainable Urban Mobility Plan (SUMP) and Actions Towards Zero Emissions in Mobility

Rome is the capital of Italy and of the Lazio region. With 2,9 million residents in 1,285 sq km, it is also the country's largest and most populated municipality and the fourth largest city in the European Union, by population within city limits. 63 percent of inhabitants travel by private vehicles or scooters and only 37 percent are using public transport, bike, or walking, with a negative impact on pollution and congestion.

The city administration hence is committed to rebalancing the modal share in favor of collective transport and also incentivizing sustainable modes, (e.g. cycling, sharing, electric mobility). The Municipal Assembly of Rome adopted on August 2, 2019 the SUMP - Sustainable Urban Mobility Plan. It is based on EC Guidelines for SUMP, adopted by Italian Ministry of Transport (MIT) in 2017 with the emission of the National Guidelines for SUMP in Italian Cities.

It is a strategic plan that defines and develops infrastructures for mobility services on a medium-term basis (10 years). It promotes safety, accessibility for all, and implements smart technologies toward a connected vehicle-infrastructure-pedestrian environment and intelligent transportation system. The urban transport system has been designed to:

Guarantee all citizens transport options to access key destinations and services;

- Improve safety conditions;
- Reduce air and noise pollution, greenhouse gas emissions, and energy consumption;
- Increase the efficiency of transport flows of people and goods.

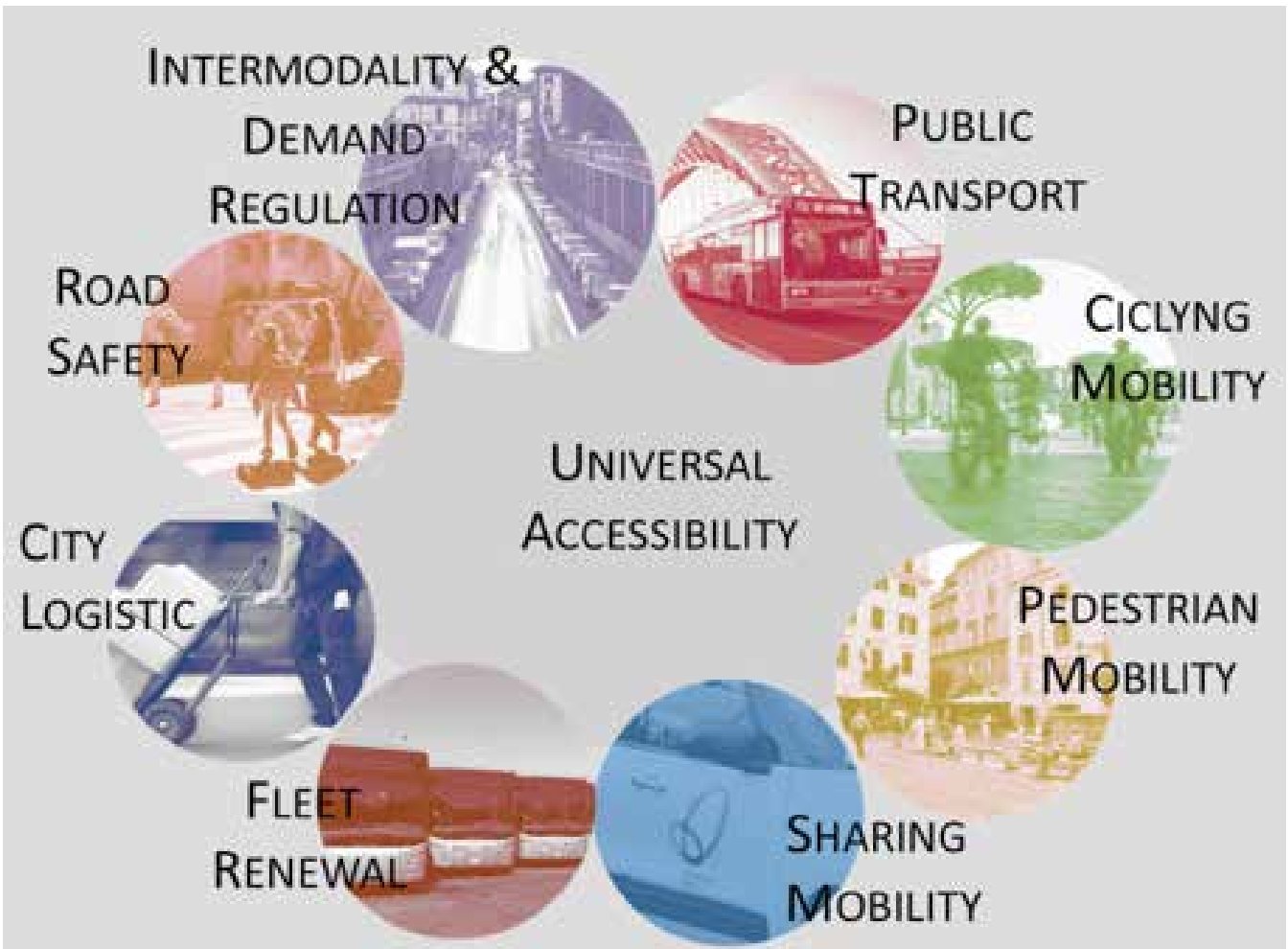
The policies and measures defined in the Rome SUMP cover all modes and forms of transport in the entire urban agglomeration, including public and private, passenger and freight, motorized and non-motorized, moving and parking. The Rome SUMP is divided in 8 main themes/components linked together by word "Universal Accessibility".

The SUMP Scenario (SP) consists of the actions and interventions identified in the Plan, to be implemented in 10 years from plan approval. The solution proposed in the Rome SUMP is the effective application of intermodality. The operation of this model will require the development of quality public transport solutions with dedicated corridors and tramways able to ensure an internal tangential effect to favor the distribution of users in a truly competitive manner against private vehicles.

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Rome Sustainable Urban Mobility Plan (SUMP) and Actions Towards Zero Emissions in Mobility



Rome has played a pioneering role since 1998 in applying the automatic control of access to the LTZ (Limited Traffic Zones). Presently the most internal zone of the city is composed by different LTZs based on ANPR (Automated Number Plate Recognition) with different time schedules, preserving the cultural heritage of the world's most important historic center.

All LTZs existing in the two most internal PGU Zones of the city of Rome are controlled by electronic access gates in each zone, including the AF1 - VAM zone which have a partial integration of the electronic gate system (red dots) under completion with green dots within this year.

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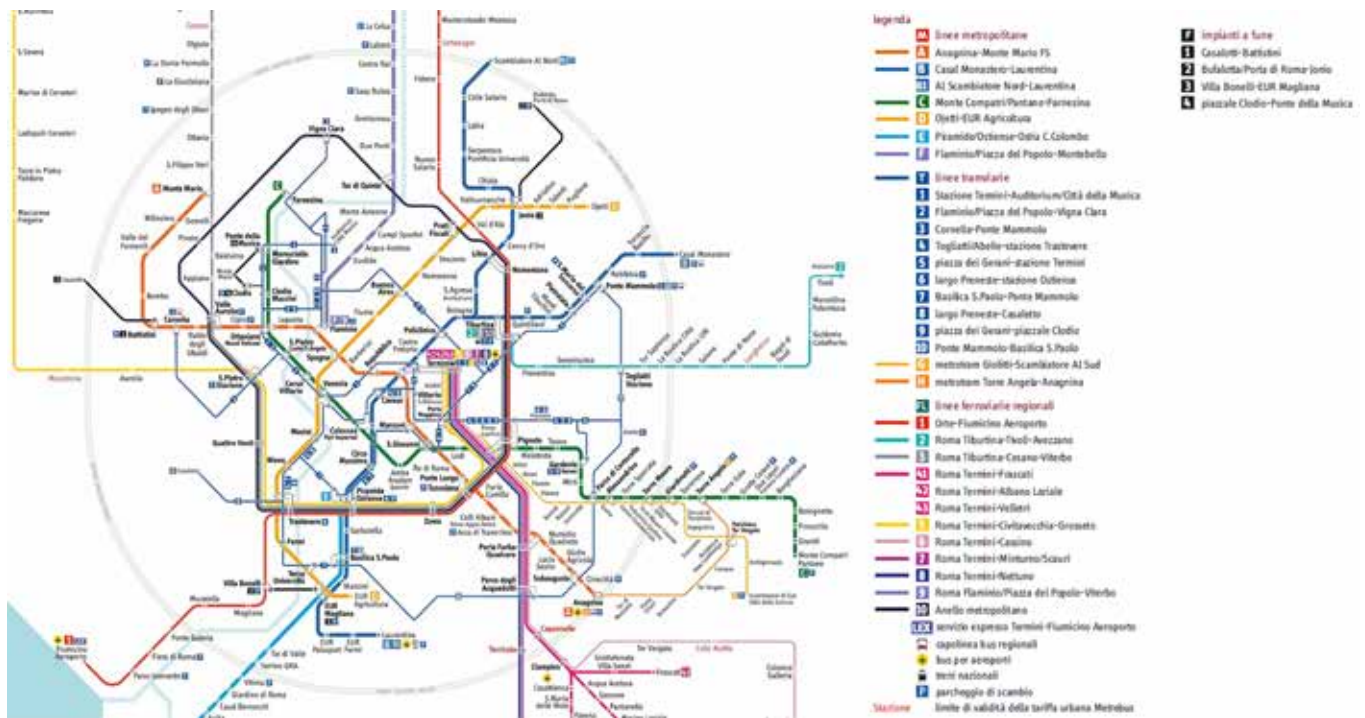
Rome Sustainable Urban Mobility Plan (SUMP) and Actions Towards Zero Emissions in Mobility

The SUMP expects the implementation of a “Pollution Charge” scheme in the external VAM area, introducing access fees as well as measures to inhibit access for the most polluting vehicles.

For what regard Public Transport, the SUMP expects investment in PT infrastructures for more than 9 Billion euro within the next 10 years with the growth of metro (+ 38,5 km and 27 new stations) and tramway lines (+58 km) and intermediate systems (+ 9,8 km), giving to Rome a modern PT network.

At the same time, the SUMP Scenario expects a complete renewal of the PT surface fleets towards low emission and ZEV vehicles within 2030. The renewal has already been running since 2019, with 682 new vehicles and revamping of 60 electric buses expected within the next three years.

Sharing mobility is a strategic action of the plan, with further impulse to car/bike/scooter sharing schemes, car-pooling and taxis towards low environmental impact solutions, with rewarding criteria for operators extending the service in the external areas of the city.



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Rome Sustainable Urban Mobility Plan (SUMP) and Actions Towards Zero Emissions in Mobility

ITS systems and the use of Big and Open data will permit effective regulation, control and information policies, and the ability to limit excessive use of private vehicles in. The heart of the integrated system is the Rome Mobility Centre, which performs the task of monitoring, managing, and controlling urban traffic.

The center is therefore a tool for collecting information in a database and for measuring the trends of urban mobility both from installed systems and external providers, such as ANAS and Regional authorities which provide an overview of the current situation.



The Rome Mobility Centre

Interventions should also promote the reduction of accidents, especially for the most vulnerable categories (cyclists, pedestrians, the disabled) and, in general, the number of deaths and injuries on the road, with a real application of the “Vision Zero” program by 2030.

The Logistic Plan included in the SUMP is a good example to explain the attempts of the City Administration (CA) to encourage public and private cooperation in mobility. Incentives from CA are given for the purchase of low environmental impact vehicles and an increased offer of freight stalls will be made available next years.

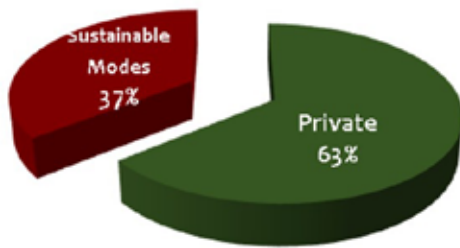
With the implementation of the SUMP, we should see in about 10 years the reduction of the use of private cars (37,4 percent) and of the motorized two-wheels (10,3 percent), while the PT should be used by 42,1 percent of the people and the remaining 10,2 percent will be made by feet, sharing, and bike.

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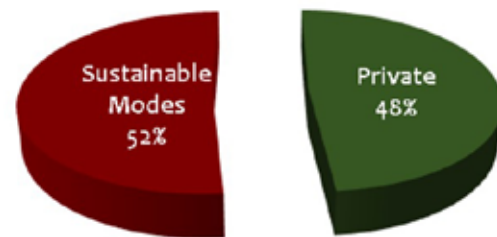


Rome Sustainable Urban Mobility Plan (SUMP) and Actions Towards Zero Emissions in Mobility

Present Situation



SUMP Scenario (SP)



The financing of SUMP measures is already achieved by multiple sources for the Reference Scenario (i.e. short term – next three years): Italian Ministries for the Transport and Environment, EU Structural Funds (PON Metro and ERDF POR Lazio 2014-20), EU Horizon 2020 for the R&D activities, complemented by internal Rome funds. The SUMP Scenario Plan (10 years Scenario) is partly financed by the Ministry of Transport with yearly call for PT infrastructures.

Finally, Roma Capitale decided in 2018 to adopt the C40 protocol – “FOSSIL FUEL FREE STREETS” (FFFS) Declaration of the C40 international network which consists of two objectives, i.e. the purchase of only emission-free PT vehicles starting from 2025 and the realization of at least one urban area “with zero emissions” from transport by 2030.

Mobility-as-a-Service (MaaS) in Riyadh

Riyadh aims to develop a fully integrated “mobility-as-a-service” (MaaS) application that combines public transit and other shared mobility services through a single user-centric interface, allowing users to plan and pay for a journey across Riyadh using multiple modes of transportation

The MaaS app will include solutions like ride-sourcing, demand-responsive bus services, and smart parking garages that sense available spaces and provide directions to them. MaaS will revolutionize the way people get around and could shift an increasing amount of existing travel demand in Riyadh from personally-owned vehicles to demand-responsive services.

From an operations standpoint, cameras will continuously be monitoring crowds, thereby helping us deploy the right train capacity in a responsive manner. Trains are all driverless, where each will have its own Operations Control Center (OCC), which will all link up to a center Transport Control Center (TCC). Comprehensive performance dashboard will aggregate the key performance indicators needed to monitor performance in the time intervals needed, from real time to periodic times such as hourly, daily, weekly, monthly, and annually.

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Mobility-as-a-Service (MaaS) in Riyadh

Integrated into a single platform, Riyadh City Brain, will serve as a hub database for all stockholders in the city of Riyadh. The Riyadh City Brain initiative is an integrated Artificial Intelligence (AI) based data platform to utilize comprehensive real-time city data including Smart Mobility, Traffic Management, Parking Management, Security, Public Transportation, Education, Health, Entertainment, etc.

Rome's Mobility Innovation with Electric Cars

Roma Capitale aims to incentive virtuous behavior and implement the Electric Mobility Plan for the city. There are already 118 charging stations—97 for cars, 12 for motorbikes and 9 for car sharing—activated by ENEL with the coordination of Roma Capitale and the technical support of Roma Servizi per la Mobilità. Roma Servizi per la Mobilità has drawn up a first draft of the, “Rome Plan for public recharge”, defining specific actions to support the automotive charging systems.

The Sustainable Mobility Plan- SUMP states where the charging stations should be located in order to have an adequate coverage of the 6 city zones. By 2020, the total demand will be of 700 charging stations, integrated by fast recharge stations located at gas stations along the GRA (Grande Raccordo Anulare – Great Ring Road) and along the railway ring.

Multimodal Transportation in Rome After the COVID-19 Lockdown

With regard to sharing mobility, on the 29th of April 2020, the Capitoline Council approved new guidelines on “free floating” rental services of scooters, mainly electric, thus encouraging shared mobility systems in view of the partial reopening of city activities after the Covid-19 emergency. All operators interested in providing the service must comply with minimum standards, such as the limit of the number of scooters, and rules on circulation (speed limit), and parking similar to those already in force for bicycles. The service operators will also be required to communicate data in real time to Roma Capitale. The project foresees a two-year experimental phase.

The main goal of the Rome Administration is to offer alternative and sustainable vehicles to private cars. For each operator, the fleet must consist of a minimum of 750 and a maximum of 1000 vehicles. A maximum of 16,000 scooters will be allowed to circulate throughout the Capitoline territory. Each vehicle must be localized in real time and operators must also guarantee an insurance coverage for the use of the scooters.

Rome Sustainable Mobility Plan (SUMP) includes actions to increase active mobility as well as to better integrate it with Public Transport (PT).

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Multimodal Transportation in Rome After the COVID-19 Lockdown

Cycling is considered a powerful way to address challenges of traffic congestion, air pollution, and scarcity of public space. The SUMP Reference scenario (interventions already financed) expects 91 km of new cycling routes in the first three years, while the SUMP scenario plan (10 years plan not yet financed) includes further 304 km of new cycling routes. Furthermore, the realization of 80 new complex pedestrian and semi-pedestrian areas is expected, of which 3 with work in progress, 8 already designed, 16 called by City Districts, 11 in the Historical Centre and the rest in peripheral areas proposed directly by the citizens and civil society. In May 2020, Roma Capitale approved an extraordinary plan to develop 150 km of temporary cycle paths, built with light materials in compliance with provisions of the SUMP plan. The establishment and construction of such 150 kilometers of new cycle routes on the main streets of the city and on other “strategic” itineraries will create a network with the aim of encouraging active and sustainable mobility in the so-called «Phase» 2 of the health emergency. The new cycle routes will offer a valid alternative to the use of private cars, especially for short journeys less than 5 km, and they will be integrated with the public transport by creating as rapidly as possible an interconnected network of cycle lanes mainly on the right side of the roadway.

The following bike lanes will be developed at first:

- Extension of the Tuscolana cycle path, from Piazza Cinecittà to Largo Brindisi, and from the Nomentana cycle path, up to Piazza della Repubblica.
- New cycling lanes from Piazza dei Giureconsulti to Porta Cavalleggeri and from Piazza Pio XI to the Colli Portuensi;
- New cycling paths from Fonte Laurentina to viale Cristoforo Colombo and from Piazza Cina to Viale Egeo.
- The bike-lanes' works started in May 2020, using financial resources already allocated in the financial city budget, complemented by other resources.



Reopening the City of Rome

After the Covid-19 emergency, the Rome Administration will focus even more on “intermodality”. The flexible usage and the combination of different transport modes, known as intermodality, plays a growing role in large cities and is being discussed as a key to a more efficient—in terms of being friendlier to the environment, healthier, and more socially inclusive—urban transport system. As a result of good public transport infrastructure and short distances in city centers, users increasingly combine walking, cycling, and public transport in an individual and situational way.

The usage and combination of different modes of transport also offers the possibility to optimize mobility towards matching personal wishes in terms of costs, time, or activity and to contribute to a healthier and more sustainable life in cities (less cars, congestions, emissions). Combining different transport modes can help cut private vehicle use enabling cities to better cope with problems like traffic congestion, a lack of parking space, and emissions.

In the framework of the emergency measures adopted by Roma Capitale to deal with the Covid-19 pandemic, in big cities like Rome the greatest difficulty is to think a PT system that guarantees safety conditions and social distancing. To keep distance, position markers of where people can stand on-board and off-board as well as for sitting in alternate places are essential. Capacity must be reduced to 50 percent, with passengers wearing safe masks and gloves (compulsory and enforced by law). There is the need to protect personnel (safe mask and other protection) and to guarantee extra cleaning, as well as to increase the number of trips on the busiest lines. These measures are generating less revenues and increase of costs for PT operators.



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