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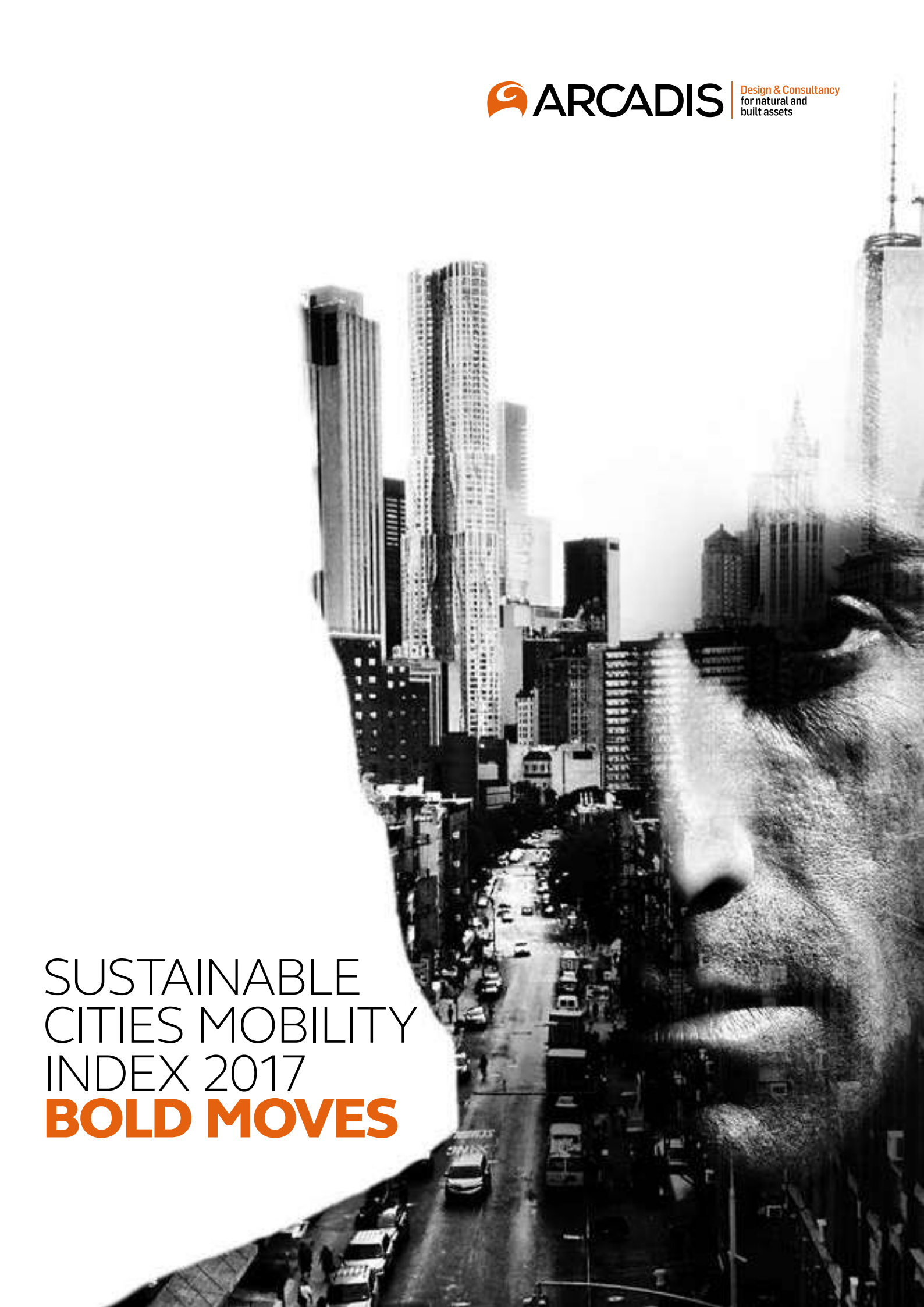

SUSTAINABLE CITIES MOBILITY INDEX 2017
BOLD MOVES

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1.0 FOREWORD

As rapid urbanization, aging infrastructure, population growth and climate change continue to challenge our world's cities, those that choose to make bold moves in advancing and diversifying their urban transport systems will gain a competitive edge - we see that investing in improved and sustainable mobility will give cities enhanced productivity, attractiveness and overall quality of life. Indeed, now is the time for cities to invest in their future. Budget is but one of the critical success factors. Boldness, audacity and vision likewise are important qualities for urban decision makers to improve quality of life in their cities. A standstill is not a viable option.

Cities are in part defined by their distinct urban transport systems; installed to traverse their unique topographies and urban realities including density, demographics and design. Whether it's London's Tube, the Los Angeles freeways, Hong Kong's MTR System, Sydney's ferries or Amsterdam's bicycles, the prevailing urban transport system of a city is a distinguishing feature that enables the mobility of residents, travelers, goods and services. The three top things I hear residents reference about their city regarding mobility are the cost and time (including dependability) of their commute and air quality.

In this latest installment of our Sustainable Cities Index, we focus on urban mobility - recognizing that transportation is a crucial part of our daily lives and an area undergoing significant transformation globally. Take for example the future of automotive transport and the fast-moving trends in connectedness, electrification, sharing and autonomous driving leading to the eventual realization of the Hyperloop, autonomous vehicles and more. Additionally, an imperative for sustainable urban living is to design and retrofit our cities to move residents from the automobile to diversifying across mass transit, cycling and walking based lifestyles. Not all cities are in the same place in their mobility journey, as some have complex and aging systems while others are building new networks, but all can learn from each other and evaluate through the same criteria as a starting point.

We have designed the Sustainable Cities Mobility Index as a framework to evaluate the social and human implications of urban transport, as well as the environmental impacts and aims of a city's mobility system. Since mobility enables access to workplaces and resources, we also assess the efficiency and reliability of a city's urban transport system to facilitate growth and support commerce. Through a selection of twenty-three evaluation criteria, 100 cities are ranked as a means to identify which ones are most progressed in achieving sustainable mobility as the city stands today. Building from the rankings, the intent of this report is to showcase ways in which cities have and can advance sustainable urban mobility solutions. And in the words of famed anthropologist and philosopher Herbert Spencer, best known for the expression "survival of the fittest", I challenge cities to "be bold, be bold, and everywhere be bold."

John J. Batten

Global Cities Director

2.0 EXECUTIVE SUMMARY

Mobility systems are key to the everyday functioning of a city. Arcadis' 2017 Sustainable Cities Mobility Index, compiled in partnership with research firm, Cebr, tracks the overall performance of the mobility systems in 100 cities around the world. The Index is built from 23 individual indicators, each reflecting a component of urban mobility, from infrastructure spending commitment to affordability of public transport. These indicators are grouped into three sub-indices: People, Planet and Profit. Combining these individual metrics and sub-indices into an overall Index score gives an indicative picture of the current state of a city's urban mobility environment.

The main findings of the Index are:

- Hong Kong takes the top spot in the overall Index. The Asian city also tops the People sub-index, boosted by its innovative and well-connected metro network and a high share of trips taken by public transport. It takes sixth place in the Profit sub-index.
- By region, European cities most consistently rank the highest, occupying seven of the top ten spots. Zurich, Paris and Prague are the highest placed European cities, ranking second, third and fourth respectively, benefitting from strong scores in the Planet and Profit sub-indices due to established infrastructure, efficient metro systems and commitment to green technology. Zurich takes first place in the Profit sub-index. With a highly affordable system, the Swiss city boasts one of the highest public transport journeys per capita of any city in the Index.
- Other Asian cities also rank highly, taking three of the top ten spots. Modern metro systems, large airports and low usage of private vehicles help boost the rankings of developed Asian cities such as Seoul and Singapore. Other Asian cities would score higher were it not for damaging levels of urban pollution and emissions.
- North American cities are spread throughout the Index. The lowest ranked North American city, Indianapolis, is weighed down by a high share of journeys made by private car, a common practice in many American cities. The highest ranked, New York City, is placed 23rd overall and second in the People sub-index with an expansive and heavily used metro system operating around the clock.
- Australian cities are mixed throughout the Index, with some cities' scores weighed down by a low uptake of public transport and lack of a metro network. Encouragingly, Sydney and Melbourne are both currently building underground metros.
- German cities take the top three spots on the Planet sub-index, with Frankfurt taking first place thanks to the city's many green spaces, low air pollution levels, and encouraging lower emissions vehicles to reduce greenhouse gas emissions.
- All cities in the Planet sub-index's top ten are European. Developed European cities, with the privilege of having industrialized early, have helped progress the low-emissions agenda with excellent bicycle infrastructure, commitment to green technology and electric vehicle uptake.
- European cities also dominate the profit sub-index; seven of the top ten cities in this category are European. Many such cities have invested generously in transport infrastructure and have widely utilized public transport systems helping to cut commuting times.
- On the People sub-index, Asian cities are out in front – of the top ten, half are within Asia. Investment in modern metro systems and transport technology has helped cities such as Tokyo, Seoul and Beijing score well in this sub-index.
- The data highlights that the wealth, size or age of a city does not necessarily equal sustainable urban mobility. This is clearly demonstrated as we compare wealthy cities like Hong Kong (1st) with Los Angeles (72nd); massive urban centers like London (7th) with Jakarta (89th); and some of the earliest developed cities like Paris (3rd) with Cairo (94th).
- Mobility favors the bold. Those cities that have pursued bold moves of innovation and planned for future growth see the greatest sustainability and quality of life benefits. Sustainable systems depend on the decisions of city leaders and disruptive technologies mean there are more opportunities than ever to create cities that are built to move us into the future. With all the challenges that come from rapid urbanization, policymakers must take note and become well informed of their options in order to be able to offer residents real social and economic benefits.

3.0 SUSTAINABLE CITIES MOBILITY INDEX

3.1 THE IMPORTANCE OF SUSTAINABLE URBAN MOBILITY

Efficient urban mobility allows people to flow through a city; it connects workers, industries and ideas, and provides a foundation for economic growth. For visitors and locals alike, the transport and mobile infrastructure form fundamental parts of any city. Increasingly, cities face enormous pressures as they seek to meet today's mobility challenges. The modern city must be proactive around rapid urbanization, climate change, pollution and asset performance while attracting commercial business and financing, and competing with other cities for investment. Today's policymakers must meet those immediate needs, without compromising the needs of tomorrow – their actions will be critical for shaping our urban future.

Although every city has its own distinct mobility system built to deal with its unique environment, certain key metrics can be used to compare systems around the world. The Sustainable Cities Mobility Index seeks to do this through an indication of sustainable urban mobility that includes measures of the social, environmental and economic health of a city's mobility, as shown in Figure 1. These are the three 'P's, the three key pillars to sustainable urban mobility: People, Planet and Profit.

Arcadis commissioned the Centre for Economic and Business Research (Cebr) to explore how cities are performing across these three areas. Cebr assessed the quality and sustainability of mobility systems in 100 cities around the world using 23 indicators. A city receives a score on each of the pillars of sustainability and a city's overall score is equal to the average of their score in the three sub-indices. A full list of these indicators can be found in Table 1 in the Appendix to this report.

An effective transport system is one which can simultaneously address and improve its functioning for all stakeholders, while facilitating economic opportunity without compromising environmental concerns. Therefore, for a city to achieve a high score, each of these pillars must be strong.

An overall score of 100 percent would mean a city has achieved top scores in each of the separate sub-indices and is among the top cities in each indicator. Scores are comparative and calculated relative to other cities in the Index, thus higher scores reflect a stronger overall performance.

Figure 1. The three pillars of sustainable mobility

While geographical factors such as location, climate and access to resources can make like-for-like comparisons problematic, the report gives cities the opportunity to measure their overarching performance across these three areas, each vital for sustainable mobility, to benchmark and learn from higher-placed cities and take action to sustain future performance.

3.2 OUR RESEARCH FINDINGS

The research indicates two overarching areas of correlation:

- Cities benefiting from 'money, mass or maturity', namely high wealth, significant global cities, do not necessarily lead the ranking in sustainable urban mobility. Although these factors can help, we do see wealthy, large and/or older cities not automatically punching their ticket to sustainable urban mobility. This is clearly demonstrated as we compare wealthy cities like Hong Kong (1st) with Los Angeles (72nd); massive urban centers like London (7th) with Jakarta (89th); and some of the earliest developed cities like Paris (3rd) with Cairo (94th).
- Mobility favors the bold. Those cities that have pursued bold moves of innovation and planned for future growth see the greatest sustainability and quality of life benefits. Sustainable systems depend on the decisions of city leaders and disruptive technologies mean there are more opportunities than ever to create cities that are built to move us into the future. With all the challenges that come from rapid urbanization, policymakers must take note and become well informed of their options in order to be able to offer residents real social and economic benefits.

3.3 **OVERALL INDEX RANKINGS**

The overall Index rankings reveal some key trends. Firstly, Europe dominates the top of the Index. Of the top ten places, seven are taken by European cities. Many of these European cities benefit from established and well-used metro networks such as London's Underground, strong bicycle infrastructure in cities like Amsterdam and Copenhagen, and high shares of commuters using public rather than private transport. European cities are also environmentally conscious, with incentives to lower emissions reflected in cleaner air and greener mobility systems. Cities such as Zurich, Paris and 18 other European cities reflect these characteristics and sit in the top quartile of the Planet sub-index.

Yet, the top spot in the Sustainable Cities Mobility Index is occupied by Hong Kong. The Asian city's mobility system, underpinned by a well-organized, modern and efficiently funded metro system, manages to achieve many of the aims of an effective urban transport system – enabling comprehensive mobility around a city, creating economic opportunity and enriching the lives of citizens, business and tourists alike. Two other Asian cities are in the top ten of the overall Index: Seoul and Singapore rank fourth and eighth, respectively.

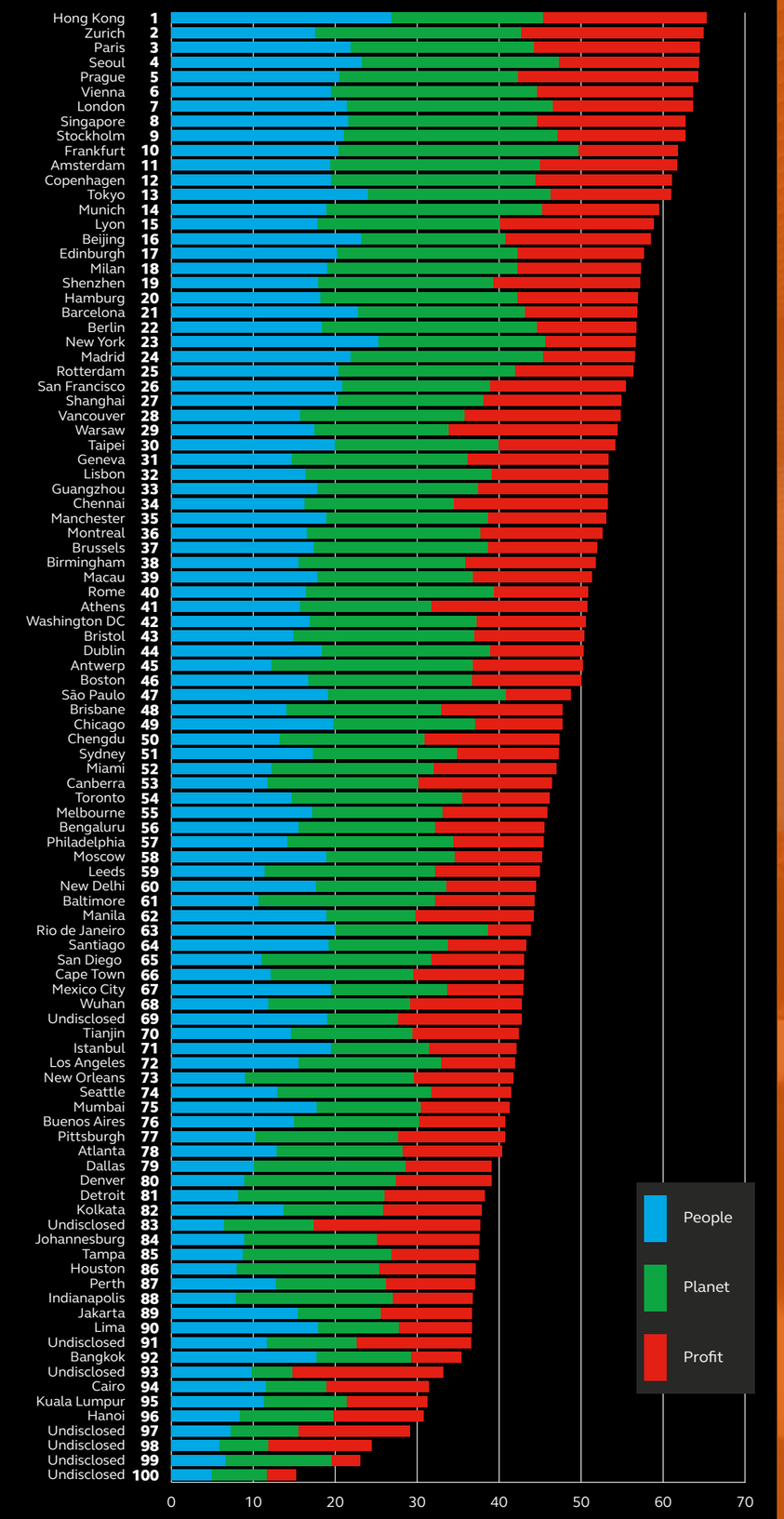
North American cities are spread throughout the overall Index, ranging from New York in 23rd place to Indianapolis in 88th. While citizens of some American cities enjoy well-funded and comprehensive transport systems, many cities in the U.S. and Canada are undermined by a reliance on private vehicles and underdeveloped public transport options.

Most Australian cities sit in around the middle of the overall Index. A lack of comprehensive underground metro systems and dependence on private vehicles deters mobility in Australian cities, and all have less travel made by foot, bike and public transport than their peer cities. Greater utilization of urban public transport would improve mobility in cities like Perth and Canberra. Promisingly, underground train networks are being expanded in Sydney and Melbourne, and under consideration in Brisbane.

South American and African cities sit lower in the overall Index. Cities like Rio de Janeiro, Buenos Aires and Santiago are hampered by congested roads and relatively low commitment to infrastructure spending. Cities such as Cairo still has some way to go in providing infrastructure for a popular and well-used mobility system.

The research examines further the three sub-indices to see in which dimensions of sustainability cities are performing well in mobility and in which areas they have opportunities to boost investment and improve quality of life.

Figure 2:
Overall Index Rankings: Hong Kong tops the Sustainable Cities Mobility Index (Source Cebr)



3.4 **PEOPLE SUB-INDEX**

The social and human implications of mobility systems

The People sub-index is made up of a range of metrics that reflect the implications of a mobility system for those using it. The sub-index combines key statistics including transport coverage, reliability, hours of operation and, ultimately, the popularity of the system.

For a city's transport network to be effective and functional for all residents, comprehensive coverage is required. Patchy transport systems mean that many residents will opt to use private transport instead. Thus, density of bus and metro stops is a key indicator in the People sub-index. San Francisco scores well in this metric, with a dense public transport network across the city, the highest of any American city in the sub-index at 12th place.

A key concern for urban dwellers is the modernity and operating hours of their city's metro network. A newly renovated or expanded network, which customers can rely upon day and night, allows people to travel freely at their own convenience. Cities are also rewarded for the digital capabilities of their metro and bus networks in the People sub-index, assessing whether or not customers can access internet on trains and buses, use smart cards and payment systems for easier city travel, and plan trips on smart phone applications. Hong Kong's modern metro system, which allows riders to use 3G internet in all tunnels and stations, helps the city top this sub-index.

Another key output of the People sub-index is modal split – the share of trips in a city taken by public transport. Cities with comprehensive public transport coverage tend to get citizens out of private vehicles, which can be costly both in terms of pollution and congestion. Many Asian cities score well in terms of modal split. More than half of total trips taken are made by public transport in Tokyo and Seoul, and both cities are in the top five in the sub-Index, as shown in Figure 3. UK cities also score high on modal split, with, for example, 43 percent of journeys in London made by public transport.

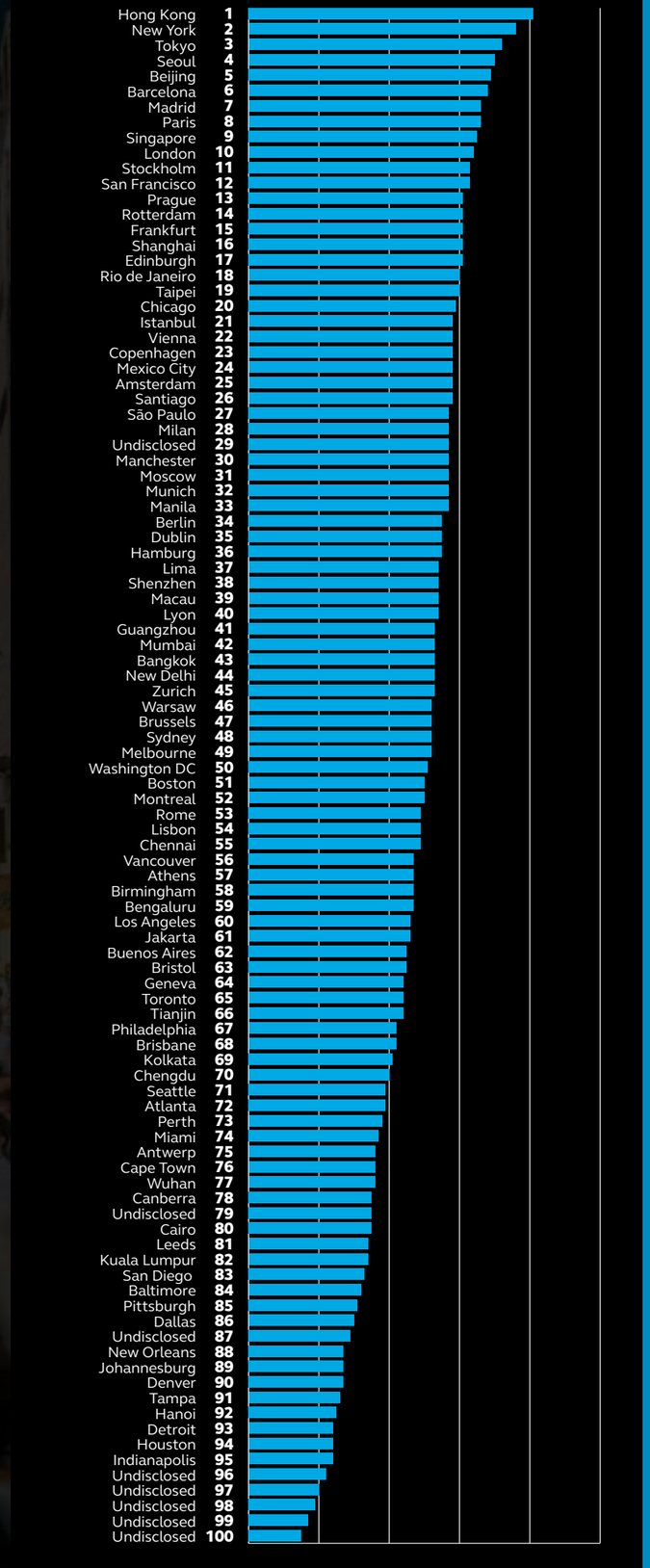
Cities around North America are weighed down by modal split. In Houston, Indianapolis, Dallas and Atlanta, an especially low share of journeys are made by public transport. In contrast, where American cities have advantage is in wheelchair access on their transport networks, with cities including Pittsburgh, San Diego, New York and New Orleans all topping in this indicator.

Mobility extends far beyond a city's own geographical boundaries. Connectivity in a modern city also depends on links to other cities and countries. Therefore, a metric for the access to other destinations is included, looking at the traffic through the city's main airport. Key international hubs such as Tokyo score well in this indicator.

Many South American cities' transport systems' commitment to people-centric policies is reflected in this sub-index. Both Rio de Janeiro and Santiago display this, placing 18th and 26th respectively. Rio de Janeiro boasts a dense public transport system with a solid use of modern technology. Sao Paulo, 27th in the sub-index, also scores well for integration of digital technology in its transport network and has become a leader in popular transport movements such as car-free days.

People

Figure 3:
People sub-index:
Strong Asian showing
(Source Cebr)



3.5 **PLANET SUB-INDEX**

Environmental impacts and aims of the city's mobility system

The Planet sub-index assesses cities in terms of a variety of environmental measures, including current levels of greenhouse gas emissions and air pollution, efforts to lower transport emissions including incentives for low-emissions vehicles, bicycle infrastructure and electric vehicle incentives as well as efforts to lower levels of road congestion and increase green space covering the city.

The German cities of Frankfurt, Munich and Berlin take the top three spots in the Planet sub-index. Frankfurt's ranking is a result of several environmentally friendly attributes, including the city's cycle readiness, numerous green spaces and low levels of pollution and emissions.

All top ten spots in the Planet sub-index are taken by European cities, many of which benefit from their status as service-driven, developed cities. Yet, many of the bolder moves taken in these cities – from fostering cycling cultures through sharing schemes to incentivizing greener vehicles – could be replicated in other cities around the world.

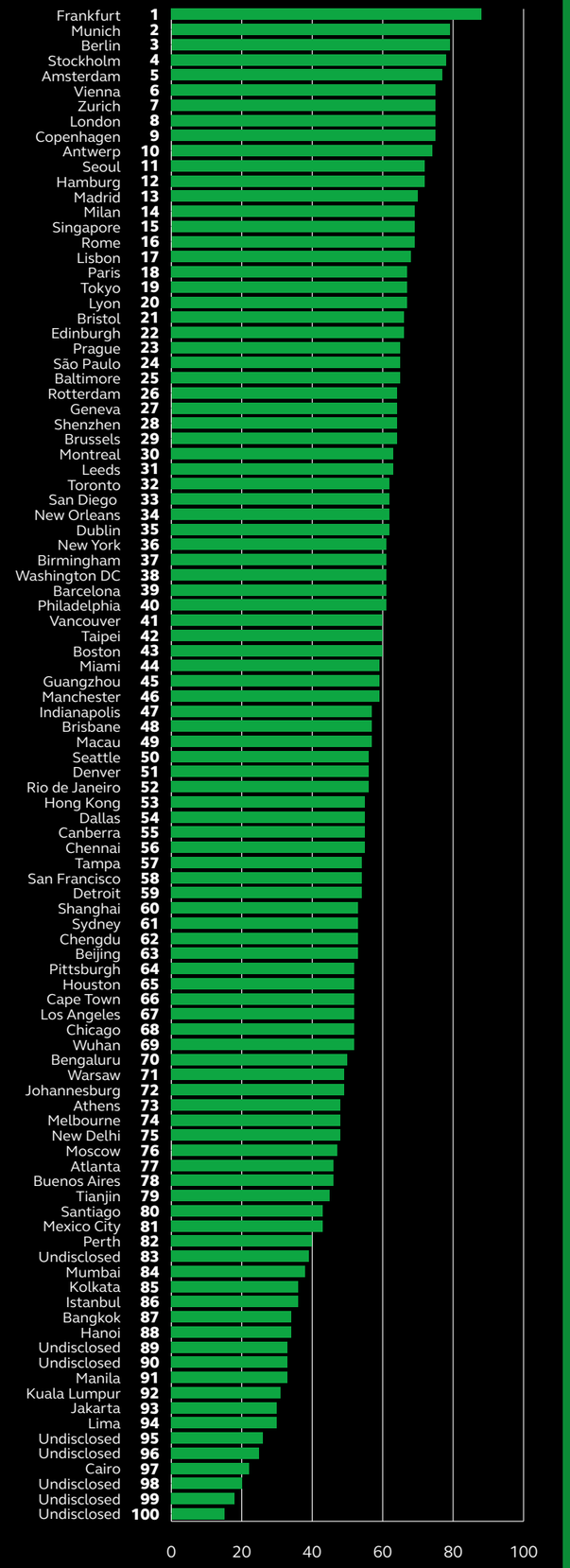
The placing of U.S. cities is hindered by high greenhouse gas emissions. Heavy emitters Houston, Chicago and Atlanta all place lowest in the world on this indicator. These cities also have relatively high congestion and delays. This underlines the chief factor holding back American cities from moving towards sustainable mobility – an overreliance on private cars. In addition, the commitment to the low emissions agenda in America lags behind other developed nations.

Many Asian cities are also emitting high levels of pollution, hampering their scores in the sub-index. Large amounts of harmful pollutants in the Indian cities of Mumbai and New Delhi heavily impacted their ranking. This was also the case in many Chinese cities such as Wuhan, Tianjin and Beijing. Furthermore, few Asian cities have instilled low emissions zones with the notable exception of Tokyo, which introduced the world's first low emissions zone.

Some cities in the Index with major ports also placed lower in the Planet sub-index. Cities such as Shanghai and Rotterdam, both established international hubs for maritime trade, are good examples. Hong Kong, which ranks first in the overall Index, posted its lowest ranking in the Planet sub-index, at 53rd. This is due mainly to the high levels of pollution caused by busy ports as key industrial harbors have high levels of container traffic every day. However, ports also bring key economic opportunities to cities, as vital components of international supply chains. The challenge for port cities will be to reconcile economic gains with the environmental costs of shipping and trade. Strategies such as Rotterdam's deployment of drone 'waste sharks' to clean up the city's waterways are a step in the right direction. However, limiting the pollutants in the water and air from incoming vessels is still a challenge for most port cities and negatively contributes to their greenhouse gas emissions.

Planet

Figure 4:
Planet sub-index:
Europe takes top 10
(Source Cebr)



3.6 **PROFIT SUB-INDEX**

The efficiency and reliability of a mobility system to facilitate growth and support business

The Profit sub-index assesses the economic aspects of a city's mobility system. This includes some key metrics for those living and working in a city, such as average commuting time – time spent commuting is (usually) lost economic productivity.

This sub-index also looks at a city's financial commitment to transport infrastructure and the financial wellbeing of the system. The sub-index assesses the utilization of the mobility network, rewarding cities with well-used public transport.

Zurich takes first place in the Profit sub-index. This global financial center has a highly affordable and efficient transport system, which is subsequently one of the most popular networks of any city in the overall Index with a highly utilized system.

Cities such as Paris, Prague and Stockholm are popular too, in terms of annual ridership on public transport. Due to well-run public transport systems and investment in alternative commuting methods, many European cities benefit from high scores in the average commuting time indicator. The average commute in Amsterdam, for example, takes under half an hour each way – in part thanks to the city's cycle-friendly roads relieving pressure from the trams and trains.

Affordability of public transport is a strong suit of many Asian cities. In Taipei and Wuhan, a monthly travel ticket costs just 1.5 percent and 1.4 percent of typical monthly earnings. This helps popularize public transport, which has a number of positive follow-on effects such as increasing the proportion of journeys made on public transport. By contrast, Londoners need to spend an average of 5.9 percent of monthly earnings to purchase a monthly pass.

Many North American cities are middle of the road in the Profit sub-index. A key reason for this is relatively low utilization of the urban public transport systems, with many residents still preferring to use private cars. Some American cities also lack financial commitment to improving city transport. However, Vancouver outranks any other city in North America, placing eighth overall, due to a relatively well-used public transport system and forward-facing commitment to improving infrastructure.

Figure 5: Profit sub-index: Europe takes seven of top ten
(Source Cebr)

4.0 CREATING THE FUTURE OF SUSTAINABLE MOBILITY

There is no one-size-fits-all strategy for sustainable mobility in cities. As the Index demonstrates, mobility challenges differ from city to city and vary according to geographical, ecological, economic and political factors. In this section, we outline some of the top trends in urban mobility as well as looking to the future to provide food for thought for those responsible for their city's mobility.

The Index clearly shows that many of the world's developed and emerging cities still have important steps to take to become sustainable and to cope with their mobility challenges. Many cities do not have the policies and practices in place that allow them to efficiently manage their mobility systems. Even higher-ranked cities are not ready for the challenges brought by climate change, rapid urbanization and aging infrastructure.

The task of improving a city's mobility can easily become weighed down by concerns over cost and can get lost in the bureaucratic processes of city and federal government. However, there are many things that can be done. By looking at some strategies and best practices for future city development, we can make our urban world a better and safer place to visit, live and conduct business. Cities have a great opportunity to improve their citizens' quality of life and visitors' experiences. With *boldness of vision* – the willingness to make brave decisions, financial investment and focus on relevant priorities – cities can create a better future.

4.1 THE FUTURE OF AUTOMOTIVE

Continue the conversation...

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Annual global car sales are forecasted to reach 125 million by 2025. City dwellers will buy half of those vehicles. The global vehicle fleet is set to rise from 1.2 billion today to 2 billion by 2030. Clearly, human dependency on the car is set to remain. However, it is the changing nature of this dependency that is interesting, especially when considering the challenges of sustainable urban mobility. When we think of vehicles in cities, we have a picture of congested roads, routes blocked by parked delivery vans and pollution from traffic. How does this picture fit into a sustainable future?

Examining four key technology trends shaping the automotive industry – connectedness, electrification, sharing and autonomous driving – can help us answer this question.

Connected vehicles, as part of a wider Internet of Things (IoT) ecosystem, offer many real-time driver services that are not only convenient, but also improve safety and ease congestion. By connecting to other vehicles (V2V), surrounding infrastructure (V2I) and even pedestrians or cyclists, dynamic route planning will become possible. This will allow drivers to avoid congested areas, bad weather or adverse road conditions, evade potential collisions and pre-allocate parking spaces. Greater connectivity will help us create proactive, flexible and non-intrusive road networks, transforming urban travel. Multi-modal transit and *Mobility as a Service* will become a reality, not just a futuristic vision.

The number of electric vehicles (EVs) on the roads is set to surpass even the most optimistic forecasts of ten years ago, with 40 percent of new car sales predicted to be EVs by 2040. Advancing battery technologies, greater consumer acceptance, industry emissions regulations, inner-city toll reductions and future city bans on diesel vehicles will all contribute to this growth. Zero-emission vehicles will considerably reduce urban pollution. But that's not all. EVs also have a major role to play in providing power storage for households and communities, as part of new ways to deliver electrical energy to the cities of the future.

Political regulation of zero emissions is the key driver for change and implementation of electric vehicles. In recent months, we have seen numerous governments, notably in France and the UK, announcing bold, specific timeframes for eliminating the sale of new gas- and diesel-powered vehicles. Government action, along with the automotive sector's implementation of complete EV fleets, will only accelerate this agenda, making EVs the market norm, rather than the exception.

Ride and vehicle sharing is also on the rise. Possible factors fueling this upsurge include the desire to reduce congestion, concerns over the cost of owning a car and the reduced social status associated with being a car owner (although this is not yet seen in emerging markets or the U.S.). While this might mean fewer vehicle sales for car makers, they have redressed their revenue balance by creating new business models or by buying companies offering ride and vehicle-sharing services. Evidence suggests that car and ride sharing is having an impact on the usage rates of passenger cars, typically five percent over a year, as well as reducing the number of cars on the road. However, increased uptake of car and ride sharing also poses a real threat to public transport and the revenues cities collect from fares, as people seek flexible, on-demand travel solutions. Personal lifestyle choice, social and political acceptance and digitalization are key to this transformation, and with growing awareness among the general populous, market demand will only increase.

Autonomous vehicles (AVs) are the natural next-step after connected cars. Already in test mode in several cities and car manufacturers, their mainstream acceptance seems inevitable. The potential benefits of AVs are well documented: fewer accidents, increased road utilization (as AVs can travel closer together at faster speeds), greater mobility for the aged and disabled and more efficient use of travel time, as drivers become passengers and can do other tasks during their journeys. Of course, AVs will not only be limited to passenger cars: we already have people mover pods, such as those at London Heathrow Terminal 5, and cities need to think about how such modes of transport might be accommodated into their masterplans.

However, the introduction of AV technology will not be straightforward: the challenge of providing a robust and reliable data communications network with very low latency times is just one of the many infrastructural issues that AVs pose for city planners. Other factors that city planners and urban policy makers need to consider with regard to AVs are discussed in the recently published Arcadis report, *Driverless Future*. With the arrival of AVs, associated changes in urban planning, sustainability and network resilience will subsequently redefine asset costs. This, in turn, will create the opportunity to reallocate funding to other city critical areas such as healthcare, education, housing, and community benefits. The AV agenda has the potential to improve quality of life in our cities; however, manufacturing capacity and market acceptance may lag behind digital developments.

The dawn of AV suggests that future mobility solutions need to include the personal car, in whatever form it may take. Advances in technology in the automotive industry are key to enabling an integrated urban transport solution. The aim must be to create a cohesive and sustainable ecosystem that embraces private and public transport, cycling and walking, to deliver mobility for all.

4.2 THE FUTURE OF AVIATION

Continue the conversation...

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The aviation industry, at just over 100 years old, is the youngest form of mass transportation; yet it has seen the most change of all. In the past century, we have seen the introduction of jet engines, the emergence of low-cost carriers, the creation of super-hub airports in the Middle East and East Asia, and significant changes to how we buy and organize our travel as well as how we spend our time and money at the airport.

Many of these changes have been largely predictable. Others have emerged suddenly. Lower-cost air travel, improved fuel efficiency of engines, larger payloads that aircraft can carry (providing economies of scale for the operator), could all be predicted according to the natural progression of aviation technology. In contrast, the emergence of wearable technology, the use of blockchain, government policy and international agreements, have been harder to anticipate.

Despite all these changes, greater access to cheaper aviation has created problems for travelers: airports are often located at a considerable distance from city centers and the public transport links to airports are often undesirable options. Inefficient airport procedures frequently waste valuable time between leaving home and boarding the plane, or leaving the plane and arriving at the destination. These issues, added to the problems of air and noise pollution, security concerns and the high consumption of resources, have eroded aviation's reputation.

With the increase in short-haul flights, owing to increasingly available point-to-point connections, smaller airports are becoming more prevalent. Airports that adapt to the needs of airlines spanning a range of business models, from low-cost carriers to executive travel, will enjoy a competitive advantage in attracting airlines' business. Airports that can combine this adaptability with strong surface transport links, will be best placed for future growth.

Growth alone will not, however, guarantee an airport's success. Regulations, environmental considerations and the funding of airport development will also be important factors for ensuring that airports are sustainable. This, together with operational efficiency, measured in terms of both profitability and passenger time, will determine an airport's viability.

As vehicle and rail travel evolve to become faster, more efficient and have reduced noise and emission footprints, the aviation industry will have to compensate by improving pre- and post-flight experiences. The days when passengers accepted crowded terminal buildings and long waits are numbered. More and more cities are served by multiple airports. With flying becoming a commodity, passengers base their choice of flights on convenience and comfort.

Looking forward, but maybe not that far into the future, self-flying pods or cars could disrupt traditional commercial aviation, particularly short haul travel. Uber recently announced a partnership with Dallas to demonstrate a network of flying cars by 2020. And at the most recent Geneva Motor Show, Airbus announced, from its office of Urban Air Mobility, plans to prototype a multi modal passenger pod. Developments such as these, alongside the proliferation of drones, will not only complicate urban air space but will become another dimension for mobility planners to consider.

4.3 THE FUTURE OF URBAN PLANNING: MOBILITY AND SOCIAL INFRASTRUCTURE

Continue the conversation

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Mobility supports our societies. It's essential for successful economies, strong governance, a healthy environment, vibrant cultures and our individual prosperity. Mobility means access to jobs, resources and ideas. Mobility matters to cities and their people, and is especially important to lower income residents.

From North America to Southeast Asia, climatic elements make driving an attractive option for those who can both afford a car and the time spent in congestion. Yet traffic jams are responsible for billions of dollars in lost productivity around the world, with the greatest impact seen in emerging cities.

So, what needs to be done? Equal access to affordable public transport is key to achieving effective, sustainable mobility in cities of all sizes. More choices for short and long-distance travel will help – with innovative transit hub development – to reduce the challenges of navigating the urban sprawl.

An imperative for urban design is to make walking, cycling and taking a bus or riding rail transit more attractive than sitting in traffic. This needs to be done while also getting people to where they need to go and improving the perception of 'transit-dependent' riders. Convincing upper-income citizens to use public transport, as they do without a second thought, or stigma, in London, Paris, New York and Hong Kong, is critical to increasing usage and lowering emissions. To achieve this goal, the look and branding of transport systems is critical; for example, introducing sleeker, futuristic-looking electric transit vehicles and naming new systems to highlight their efficiency and modernity (e.g. The Dallas Area Rapid Transit (DART) = fast, or TransMilenio = moving the people of today).

Big data will also be transformative. By 2020, when we leave the house for the day, we will be given choices of transport in terms of time savings, true cost, calories expended, carbon footprint and other information tailored to our individual mobility needs. Learning from the correlations of big data and mobility – how and when people move around a city – will help startups to choose where to locate, industries to access and retain talent, and students to move to the best locations for their education.

4.4 THE FUTURE OF INVESTMENT

Continue the conversation...

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For urban mobility to evolve clearly requires ongoing investment. Yet funding is not always available – the global infrastructure investment gap is estimated at €750 – 900 billion per year up to 2030. Public-private partnerships (PPPs) account for an estimated 12 percent of infrastructure investment in some advanced economies, but the global average is just three percent. The World Economic Forum has said that another means of bridging that gap lies in the "underexploited opportunity to upgrade the existing asset base", by optimizing operations and improving the maintenance of infrastructure assets.

Around the world there have been some innovative investment schemes to overcome the funding gap. In Rotterdam, the public transport company has taken the decision to make itself independent of public funding by optimizing its business model. A reward for their success will be eliminating the time-consuming bidding process for new work.

For capital projects, PPP-style initiatives are being used to secure greater investments: London's Docklands Light Rail being a successful example of this strategy. Purely private initiatives are also being encouraged as a means of funding the development of infrastructure for EVs or AVs. This enables medium-sized enterprises to provide their services and to contribute to the next generation of mobility. Private investment is also helping to fund some of the world's largest urban infrastructure projects. CrossRail2, also in London, is aiming for significant private investment by showing the positive social and economic opportunities brought by the rail line into the surrounding neighborhoods.

In Hong Kong, the corporatized public company MTR uses the profits from real estate development to pay for the extension of the mass transit rail network. It's a model now being exported to mainland China. In New York and San Francisco, tax increases, grants and loans will help cover the costs of extending the subway to Manhattan's Hudson Yards project and the Transbay Center. São Paulo is using the income of auctioned real estate development rights to fund new public transport.

Strategy and policy makers need to decide not just how, but where to invest. On the one hand, a growing urban population will require structured public initiatives. At the same time, disruptive technologies and new businesses radically change how a city functions. It is important to think about the creation of a new metro line, rapid bus corridor or a network of bicycle lanes. But, in addition, a strategy is needed for dealing with ride-sharing traffic flows around stations or the airport, car-sharing locations in city neighborhoods or even perhaps, how it might be possible to free up a physical and legal path for a Hyperloop to the next city. Metropolitan authorities, working in tandem with the private sector, will need to come up with bold, flexible, integrated and versatile strategies to fund such projects.

4.5 A BOLD VISION: THE 30-MINUTE CITY

Continue the conversation...

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The "30-minute city" is an actively debated concept, especially in Australian cities. Its goal is to engineer cities so that home, work and play are all accessible within 30 minutes. But is the "30-minute city" merely a catchy slogan, a "thought bubble", or a viable concept? Most cities are currently a long way from this ideal. Let's examine the issues associated with making this bold idea a reality.

Congestion is widely considered to be a major barrier to achieving this goal. Getting people from "A-to-B" quicker, would take cities closer to the 30-minute target. Yet while congestion is an important area to focus on, it's only part of the picture.

Realizing the aim of the "30-minute city" requires a closer look at why so many people "choose" to travel long distances from home to work. The economic stratification of nearly every large urban center means that most people get jobs where they can, but live where they can afford. In addition, many modern households rely on multiple wage earners who may work in different parts of a city.

As these factors demonstrate, there are several barriers to achieving the "30-minute city". The development of better public transport systems along the right corridors coupled with higher density housing, improved integration across public transport modes and parking provision at public transport hubs will all help.

However, ensuring the availability of a variety of housing options at different price points close to employment hubs, including affordable housing options for essential workers, is also key. Another area of focus could be the better regulation of rented accommodation, since those who rent are more mobile and therefore more likely to move nearer to work. Providing better internet services and improved tax breaks for telecommuters could also have a positive effect. Creating employment clusters, or "centers of excellence", would beneficially locate similar types of companies and jobs within the same areas of a city.

Then there are the amenities that simply make life more enjoyable and rewarding. Access to these is part of the reason why people will endure longer commutes. They also foster a sense of community and pride of place. While good schools and health services are essential, leisure opportunities are also important. These could cover a wide range of benefits, from access to open green space, festivals, sporting events or places to eat al fresco while children play nearby.

Even taken together the considerations above are probably only the tip of the iceberg. And since no city is ever going to do all these things at once, or equally successfully, the best bet may be to narrow the focus. That means prioritizing the most achievable initiatives for a given city, accepting that no city is likely to achieve the 30-minute goal across all possible dimensions. But one thing does seem certain: the concept of the 30-minute city will be central in shaping tomorrow's urban experience.

4.6 MORE ON TECHNOLOGY

Continue the conversation...

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Transport of people and goods must become more efficient and the Internet or Things (IoT) and Artificial Intelligence (AI) will also play a big role in making this possible. In the Smart City of tomorrow, self-guided transport will be essential.

Alongside urbanization, there are several other major trends dictating the needs and desires of cities' inhabitants. With expanding elderly populations, there has been a renewed focus on the issue of wellness in the urban environment. While the demands for comfort and a clean-living environment are hardly new, the ways to design for these needs are changing quickly. Large technology companies such as Tesla, Google and Apple and new companies including Lucid and BYD all understand that mobility will be key to fulfilling the needs of modern urban residents. In response, all of them have turned their attention to two key areas: the electrification of vehicles and self-driving technology. The progress they have made is already forcing existing car companies to make drastic changes to their investment and production strategies. Not only will the electric, self-driven vehicle replace the traditional car, but fewer traditional vehicles will have to be produced, as the growth of ride- and car-sharing schemes continues.

However, the future of sustainable mobility and sustainable cities is not solely dependent on these developments, but also on the commercialization of ventures by other stakeholders. The Hyperloop is an example of a promising new intercity mode of transportation. The brainchild of Elon Musk, the Hyperloop should travel the distance between San Francisco and Los Angeles in about half an hour. Two companies, Tesla and SpaceX, are working towards making the Hyperloop a reality. Aerospace companies, such as Airbus, have an even bolder vision of the future, where self-piloting drones take to the sky.

Individual innovations can be created on a standalone basis, from the bottom up. But something as big and interconnected as mobility requires systemic change. Given the substantial fixed costs of railroads, for example, it is unlikely that governments will stop running trains between cities. More importantly, it is not just the associated costs that will keep people from using electric cars for everything, but also the efficiency of train travel. In many cases trains will be the fastest option to travel from A-to-B. So rather than one mode replacing another, it becomes increasingly critical to connect the different modes by optimizing traffic flows between them.

To begin exploring this future-proof, integrated approach to sustainable mobility, Arcadis and the city of Amsterdam are running an experiment to test the feasibility and desirability of *Mobility as a Service (MaaS)*. The idea is to create an open platform connecting all modes of transport – enabling the planning of journeys, reservations using shared vehicles and a payment in a single system. To be able to truly optimize the use of all methods and modes of transport, the hypothesis is that we need a seamless customer experience through all modes. As people start making different choices for their mobility enabled by this flexible solution, we will likely see a decrease on the pressure of the crowded road network in Amsterdam's business district.

However, optimizing the logistics is not enough to create a future-proof mobility system, since this only accounts for the rational aspects of travel. Another crucial element often overlooked in the discussion about the optimal customer experience is personalization. Personalization has been a major recent trend in the auto industry, particularly since BMW MINI introduced the endless customization options on the MINI in 2001. It has been a hugely successful and profitable design strategy and business model ever since, seen equally in €12,000 Peugeots and €12 million Rolls-Royces.

Today, we don't envisage a future in which people are moved around in generic autonomous pods. Based on years of human-centric design experience, we believe that people value their individuality. This is more true now than ever. With the dawn of data science and AI, online lives have already been fully tailored to preferences and behaviors, and the physical world will soon follow. Maximizing personalized experience ought to be the premise of a long-term sustainable solution for both business and the environment in the next five years.*

**** This section also has contributions from Niels van Roij - London-based independent automotive designer***

4.7 THE FUTURE OF TRANSIT HUBS

Continue the conversation...

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It is important to recognize that system capacity is only a half of a city's mobility story. Transit-hubs are no longer simply a place where the traveler arrives or departs. The facilities in and around the hub make the area a destination itself, and can provide a ripple effect that encourages investment in the area, generate new revenue streams and boost wider prosperity. It's clear that nowadays, new transit-hubs cannot be developed in isolation from their surroundings and must be adapted to benefit the area they serve.

Developing a transit model demands planning for the future, but also efforts to realize the untapped economic, social and environmental potential of existing transport developments. Leading practices and missed opportunities in transit-hub development around the world has provided insights into optimal approaches. Using an integrated approach, Arcadis has conceived a new approach to transit-related developments called Mobility Oriented Development. Through this benchmarking approach, we focus on the key elements that bring value to transit-hubs: connectivity, urban environment, social place-making and economic development.

This benchmarking approach spotlights opportunities for cities to transform their hubs into healthy and vibrant areas. It is an experiential approach to infrastructure planning. It takes infrastructure as the foundation and builds upon it to create a space that will drive community engagement. To read more about this benchmarking approach and how to create destination hubs, please see *Our Mobile Future*.

5.0 CONCLUSION - BOLD MOVES TOWARD FUTURE SUSTAINABLE MOBILITY

Moving people, goods and ideas in, out and within a city creates a living machine: everything is dependent on mobility. Yet this machine can be broken as mobility is often one of the largest burdens on a city's residents, either through long commute times, inefficient or expensive transport and/or adverse health effects from transport pollution. If cities aren't mobile, commerce and productivity are disrupted, city competitiveness is reduced, and on a human level, urban existence becomes stressful and overwhelming. City leaders must focus on opportunities to create an efficient, safe, connected and adaptable mobility system, which will allow their city to thrive and remain competitive over the coming decades.

No two cities are the same, but every city in this Index and outside of it, can learn from policies and strategies of the others. And while every city faces its own unique social, economic and geographical challenges, each must also address the common goal of adapting its mobility system as the population and economy evolve. Now more than ever in the history of the world there are more citizens, visitors and jobs in urban centers. That means more people and goods have to be moved and if cities do not sustainably adapt to their mobility needs, it will impede their success.

The good news is that we live in a time of *Bold Moves* – where innovation, digital transformation, technology and ideas are providing provocative and timely answers to the mobility challenges confronting our cities. We don't just see the Sustainable Cities Mobility Index as a ranking of how cities are doing in responding to their mobility challenges; we see it as a showcase for the ways in which cities can advance mobility, become even more powerful economic drivers, attract greater investment and continue improving the quality of life of its residents.

We live in the most advanced technological and savvy generation yet – the speed of change is exponential. What was once considered "science fiction" (the speed of bullet trains, autonomous vehicles, flying pods, and so on) is a reality as these solutions can now be implemented to meet urban mobility challenges. With every city having its own unique vision for achieving sustainable mobility, each will need a distinct road map to reach its destination. But starting the journey begins with a clear assessment of where the city's mobility is today, and the outputs (positive and negative) that arise from the interplay between its physical, social and economic systems. Arcadis is committed to improving the quality of life in the urban environment – focusing on the values of resilience, regeneration and mobility as the key means of gaining a competitive advantage for cities. City leaders, urban planners and developers alike need experts, advisors and designers to *be bold* in co-creating a successful mobility vision. Ultimately, smart and sustainable mobility optimization ensures economic vitality and lives around the world.

6.0 **CITIES IN TRANSIT** - A SNAPSHOT OF MOBILITY AROUND THE WORLD

ASIA

HONG KONG

Hong Kong, first in the Index and the People sub-index, has long been famous for its world-class infrastructure. But as one of the planet's most densely populated cities, it faces unique challenges in providing an efficient transportation system to meet the needs of its 7.3 million people. Challenges include limited space, a growing and aging population, rapidly increasing cross-boundary traffic with China and environmental concerns.

Overall
1st

People
1st

Planet
53rd

Profit
6th

Hong Kong International Airport (HKIA) is one of the world's best and busiest, with 70.5 million passengers in 2016. HKIA is operating at 99 percent capacity, with a third runway currently undergoing construction and due to open in 2024. The expansion of the airport is intended to aid Hong Kong's role in connecting mainland China with the rest of the world, a key part of the Belt and Road Initiative, Beijing's global trade development strategy.

The controversial Hong Kong-Zhuhai-Macau Bridge is scheduled to open at the end of 2017. The bridge, beset by delays and environmental concerns, is meant to bring closer economic integration between Hong Kong and the Pearl River Delta. There is no rail on the bridge, leading to concerns among some politicians and civil society groups that the number of vehicles coming from China will compromise Hong Kong's drive for better air quality.

Hong Kong's public transportation system oversees approximately 12.6 million passenger journeys every day and the Mass Transit Railway recognized as one of the most efficient in the world. Public transport is relatively cheap compared to other world cities. Less than one fifth of people in Hong Kong own a car, but pedestrianized areas are few in number. Compared to European cities, commuting by bicycle is rare. This is partly due to Hong Kong's climate and topography, but the city has done little to encourage the uptake of cycling.

SHANGHAI

Shanghai's population has nearly doubled since 2000 to 24 million. As this rapid urbanization is showing no signs of slowing, the government is focused on a model of sustainability that accounts for the problems of limited land and public resources. Shanghai Urban Master Plan (2016-2040) takes these limitations into consideration while planning for the transformation of Shanghai into a global city.

Urban regeneration and innovation hubs will be crucial elements in transforming Shanghai from a manufacturing center into one of the most sustainable cities in China. Urban mobility will be key to this transformation, and Shanghai will be looking to further improve its transportation system. Fourteen of the city's 25 metro lines are operational, making it one of the most comprehensive in the world. New lines are being built, although they must be dug as deep as a 15-story building to squeeze under the dense maze of existing tunnels. While the metro seems in good health, the city's bus system remains ripe for regeneration.

Plans for a new major railway station are underway near Pudong International Airport. Shanghai East Railway Station is set to be the city's fourth major railway station hub and will provide a direct link to the new Disneyland Resort, drawing additional tourism and traffic to the area. Construction is scheduled for late 2017 and is expected to be completed by 2022.

The city has a staggering 450,000 shared bicycles that are unlocked using GPS-enabled mobile apps. The bikes can be picked up and left anywhere, making them very convenient for users; although illegal parking is fast becoming a major issue for the authorities. The region continues to evolve its transportation connectivity to the greater Yangtze River Delta, with new high-speed rail and urban highway connections underway.

Overall
27th

People
16th

Planet
60th

Profit
19th

SINGAPORE

Singapore continues to be a top ranked sustainable city in Asia, but the city-state is not resting on its laurels. With a population predicted to grow to more than six million people by 2030, the government has committed significant investment over the next decade to improve mobility and connectivity: two new underground lines, extensions to four MRT (metro) lines, a new terminal and runway at Changi Airport, a high-speed rail link between Singapore and Kuala Lumpur, a cross-border MRT system which will connect Singapore and Johor Baru in Malaysia and the relocation of the container port.

66 percent of journeys in Singapore are via public transport, but the government wants to increase this to 75 percent during peak hours by 2030, and it is investing in developing a more efficient and integrated bus system.

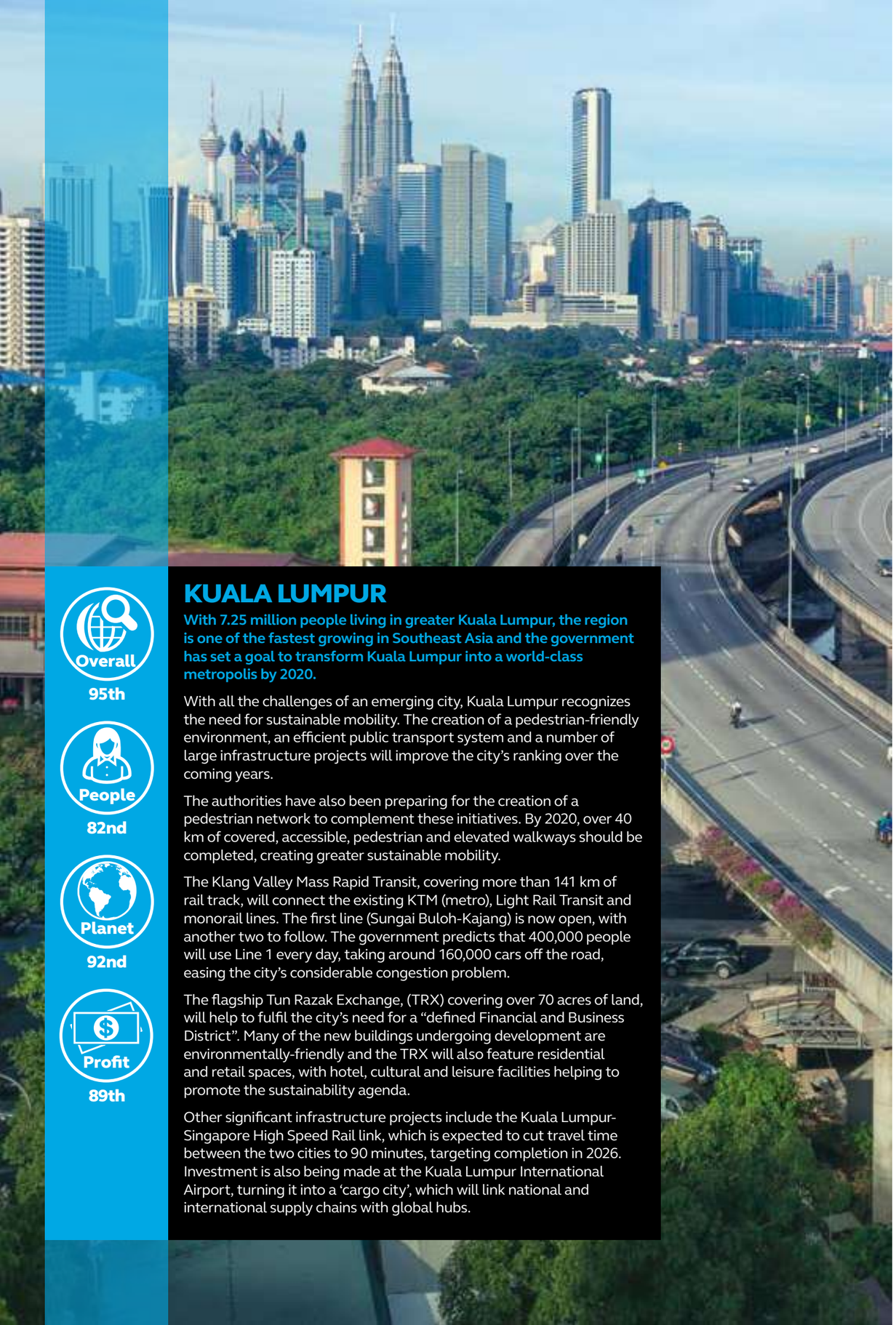
The city is well-balanced across all three sub-indices; however, a number of other initiatives are underway which will help Singapore to evolve and remain competitive. These include the government's intention for Singapore to go 'car-lite', with a SIN$1.5 billion 15-year plan which aims to reduce the country's reliance on petrol-fuelled cars. The government is also generally supportive of ride-sharing car and bicycle platforms though 'bike dumping' is an increasing problem. The small city-state is also the perfect testing ground for driverless vehicles and the government has signed deals with two self-driving technology companies to develop autonomous truck fleets for use on public roads. Singapore is also ahead of the game in using big data to study commuter flows and improve planning, which will help guide future investment.

Overall
8th

People
9th

Planet
15th

Profit
13th



KUALA LUMPUR

With 7.25 million people living in greater Kuala Lumpur, the region is one of the fastest growing in Southeast Asia and the government has set a goal to transform Kuala Lumpur into a world-class metropolis by 2020.

Overall
95th

People
82nd

Planet
92nd

Profit
89th

With all the challenges of an emerging city, Kuala Lumpur recognizes the need for sustainable mobility. The creation of a pedestrian-friendly environment, an efficient public transport system and a number of large infrastructure projects will improve the city's ranking over the coming years.

The authorities have also been preparing for the creation of a pedestrian network to complement these initiatives. By 2020, over 40 km of covered, accessible, pedestrian and elevated walkways should be completed, creating greater sustainable mobility.

The Klang Valley Mass Rapid Transit, covering more than 141 km of rail track, will connect the existing KTM (metro), Light Rail Transit and monorail lines. The first line (Sungai Buloh-Kajang) is now open, with another two to follow. The government predicts that 400,000 people will use Line 1 every day, taking around 160,000 cars off the road, easing the city's considerable congestion problem.

The flagship Tun Razak Exchange, (TRX) covering over 70 acres of land, will help to fulfil the city's need for a "defined Financial and Business District". Many of the new buildings undergoing development are environmentally-friendly and the TRX will also feature residential and retail spaces, with hotel, cultural and leisure facilities helping to promote the sustainability agenda.

Other significant infrastructure projects include the Kuala Lumpur-Singapore High Speed Rail link, which is expected to cut travel time between the two cities to 90 minutes, targeting completion in 2026. Investment is also being made at the Kuala Lumpur International Airport, turning it into a 'cargo city', which will link national and international supply chains with global hubs.

AUSTRALIA

BRISBANE

Brisbane ranks highest out of all the Australian cities in the Index. As the capital of Queensland, Brisbane is Australia's third-largest city and has the most rapid population growth rate of any capital city in Australia. Established as a port within the Brisbane River, the city offers a laid-back urban lifestyle which is subtropical, creative and sustainable.

Overall
48th

People
68th

Planet
48th

Profit
34th

Benefitting from a diverse trade industry based on aviation, sea ports and expanding industries, Brisbane also profits from its position as the gateway to Queensland's education and tourism industry and is a huge pull for the world's creative and knowledge economies. Its residents and visitors enjoy an exceptional quality of life amidst the natural beauty of Australia's eastern coast.

However, despite ranking top in Australia, Brisbane still has work to do to strengthen its infrastructure and to remain attractive, livable, and mobile: chronic underinvestment in public transport has seen the city, alongside it's southern counterparts, suffer on the global mobility stage. The mobility sub-indices show that, not only does Brisbane need to find better ways to fund public transport, it must also ensure any existing and new public transport developments are affordable and sustainable.

Aware of its mobility issues, Brisbane has a long-term plan, with major infrastructure projects including the Brisbane Metro, the European Train Control System and Cross River Rail. By delivering its major public transport infrastructure in sync with other key sustainable and smart investments, Brisbane is poised to lead the region in city development and the knowledge economy.

MELBOURNE

Australia's second largest city and the capital of the State of Victoria, Melbourne has a reputation as a thriving city with strong business, cultural and sporting sectors. Melbourne has become known as the world's most livable city, yet it ranks 55th in the Index.

Overall
55th

People
49th

Planet
74th

Profit
56th

One of the largest factors affecting Melbourne's mobility is its rapid recent growth. It is projected that Melbourne's population will double to around eight million in the next generation, overtaking Sydney as Australia's largest city. Expanding fast and with high house prices in the city center – Melbourne has the fifth least affordable housing market in the world – the city is increasingly reliant on long-range transport options.

Melbourne boasts the world's largest tram and light rail network and has recently begun the development of a cross-city Metro. This will help to free up the train network and enable more commuters to use public transport. Melbourne performed relatively well in the People sub-indicator compared with Australian cities (second to Sydney). This is despite the fact that the city does not yet have a functioning Metro network; a situation that will improve upon its completion. Melbourne already has a digital ticketing system and public transport mobile applications. Further digitization will ensure continued improvements to the mobility of the city.

Despite not ranking highly in several indicators, Melbourne is embracing the challenge of balancing city growth with an ability to respond to shocks and stresses. Key to Melbourne rising to its challenges is the Resilient Melbourne Strategy which sets out a clear, collaborative agenda to ensure Melbourne is in a strong position to deal with the problems of city growth. Combining this with the State Government's Plan Melbourne refresh, the city has a strong strategy in place to address its mobility and sustainability issues.

SYDNEY

While Sydney is well on its way to global city status, its middle-of-the-road ranking in this Index reflects historic under-investment in mass transit, compounded by increasingly rapid population growth – the city's population topped five million for the first time in early 2017.

Overall
51st

People
48th

Planet
61st

Profit
60th

Some of Sydney's lackluster performance can be attributed to the high concentration of professionals traveling into the Central Business District, which is on the city's eastern coastal edge and a significant distance from Sydney's geographical center. While initiatives from the Greater Sydney Commission and State Department of Infrastructure are driving the development of multiple business hubs, it will be some time before the benefits of these schemes are realized.

Further impacting Sydney's mobility performance are a cultural preference for single-family dwellings and a legacy of urban sprawl, coupled with Sydney's ranking as the second least affordable city for housing globally. These factors result in a high proportion of residents undertaking long daily commutes, thereby putting further pressure on congested suburban road and rail networks.

Notwithstanding these challenges, the New South Wales State Government is a strong believer in mobility as a driver of global competitiveness. Recently Sydney has made a major investment in mass transit networks, with an aggressive asset recycling strategy to ensure funding. The Sydney Metro project, currently the largest infrastructure project in the country, expansion of the light rail and regular train network upgrades, all demonstrate the city's commitment to increasing the sustainability and resilience of its public transit network.

It is with this shift that Sydney performs well in the People sub-indicator compared to its Australian counterparts. And it's through this commitment – along with better integrated land and transport planning and the smart data solutions that will ensure better intermodal connectivity – that Sydney is making steady progress towards more sustainable mobility.

AMSTERDAM

A city with more bicycles than people, 58 percent of Amsterdam's residents cycle to their destinations every day. Amsterdam's popularity is rising: tourism is increasing and more people want to work in the city. This additional growth is creating mobility challenges. To resolve these, the city has created a mobility plan that extends until 2030. The plan gives priority to pedestrians and cyclists in the city center and better access to underground parking locations. Additional and enforced bike parking is being created, to keep the city free of unused bikes. What's more, there are major mobility improvements underway to improve connections between Schiphol Airport, Amsterdam and Almere.

The Zuidas district, the business district of Amsterdam, is also growing, helped by its convenient proximity to Schiphol Airport, which is just six minutes away by train. The highways and the train stations are undergoing major reconstruction, including tunneling initiatives to improve and expand public space and to increase the capacity of the train station. The major companies located in this district are engaged in improving mobility by agreeing to commit to electric cabs, and are working together to develop Mobility as a Service for their employees.

As a part of the Smart City approach, Amsterdam has drafted a Smart mobility action plan. Within the plan lie initiatives such as smart cycling, smart parking, Mobility as a Service with real-time traffic data, advice for best travel and ridesharing options.

Overall
11th

People
25th

Planet
5th

Profit
20th

BERLIN

Population increases in Berlin have contributed to an economic growth rate above the national average, but this also presents challenges: the requirement of additional housing, more commercial space and infrastructural improvements all impact the city's mobility. To deal with these challenges, Berlin's local government will follow the Berlin Strategy 2030, which provides a framework for long-term sustainable development.

The Smart City Strategy Berlin, submitted within the 2030 strategy, aims to find solutions to these challenges and highlights the importance of innovation and technology. A key part of this strategy emphasizes smart mobility. The main elements include: shortening distances by strengthening an intelligent and sustainable transport policy to reduce the distances of individual and commercial transport; stimulating the use of new mobility concepts in line with the 'sharing economy' (e.g. car, scooter, and bike sharing) to decrease the levels of traffic and reduce adverse environmental impacts; supporting research and development in electromobility (e-mobility), to strengthen its economy by creating jobs and technical know-how, positively impacting the climate and improving quality of life in the city.

To ensure these mobility measures improve, Berlin's strategic investment includes charging infrastructure for electric cars, test tracks for autonomous vehicles, new rail tracks and improvements and extensions of bicycle paths.

Overall
22nd

People
34th

Planet
3rd

Profit
68th

Overall
10th

People
15th

Planet
1st

Profit
63rd

FRANKFURT

Thanks to its position at the crossroads of several European trade routes, Frankfurt is an international financial and trade center and is home to several major European institutions. Consequently, the number of commuters is considerable: roughly 360,000 people come to Frankfurt for work, raising the city's population to almost one million. The metropolitan region Frankfurt/Rhein-Main includes 5.5 million inhabitants, who use the transportation network to commute. With one of the largest airports in Europe, a busy interchange and the biggest passenger station in Germany (350,000 people per day), the main metropolis is a large traffic hub.

The Gesamtverkehrsplan Frankfurt am Main sets the framework for the city's mobility and traffic development. Its principal focuses are on sustainability, demographics and urban compatibility. The proportion of motorized private transport currently stands at 80 percent, which the city aims to reduce drastically.

A closer network with higher frequency is being developed for public transportation, with expansion to existing train lines and the creation of new lines being planned. Circular railways and tangential lines will be created in the hope of decentralizing traffic, and stations will be enlarged to open them up to regular city-trains and long-distance traffic. The city also aims to reduce road traffic by limiting the number of new parking spaces created in the city center and implementing a parking system favoring tenants over commuters.

The city is also following an e-mobility strategy which not only supports electric vehicles, but also encourages the use of their bicycle equivalents; more charging stations are being built for both. To deal with increased bicycle traffic, the city has devised the "Bike + Ride" concept, similar to the well-known park and ride concept for cars. To meet the expected population growth, Frankfurt is well on the way to its 2030 goal of creating a more integrated and mobile city.

Overall
3rd

People
8th

Planet
18th

Profit
5th

PARIS

Paris, third in the Index, has a strong transportation network and commitment to sustainability. This score comes from a balanced performance on the three dimensions of People, Profit and Planet, placing it in the top 20 of all three pillars. This is the outcome of a longstanding policy promoting public transportation, together with recent measures designed to aggressively develop cycling infrastructure and make the city more pedestrian-friendly. Paris was one of the first cities in the world to have a bike-sharing program and to convert a highway to a place for walking and exercise.

Paris intends to continue with its commitments to mobility. At the heart of this commitment is the major investment in the Grand Paris Express rapid metro, a system of four new state-of-the-art lines that will extend the dense and highly-interconnected network in the urban region. When completed, it is expected to carry two million people a day and will transform the lives of many Parisians. Although currently 56th in the Index for commuting time, it is expected that projects such as the Grand Paris Express will be instrumental in reducing the time Parisians spend getting to and from work every day.

Other major projects include the extension of the tram line that surrounds Paris and new rapid bus services in dedicated lanes. The city is also undertaking measures to resolve the persistent problem of air quality in the city center and to limit surface parking. Taken together, these developments suggest a mobility model in Paris that is increasingly diverse, accessible and inclusive, economically durable and environmentally sustainable.

ROTTERDAM

Rotterdam, just like any other city in the Netherlands, is a perfect place to bike. The city offers excellent and safe facilities for cyclists. Within the last decade the number of cyclists has increased by 10 percent, while the number of cars in the city center has declined since 2010. Rotterdam is home to Europe's largest sea port, due in part to its outstanding accessibility and intermodal connections, as well as its 175,000 area workers.

From north to south, daily traffic jams are common in Rotterdam. However, relief is on the way, with newly constructed tunnels and future plans for improvement. Public transport in the city has been significantly upgraded, with a remodeling of Rotterdam Central Station, the provision of extra park and ride facilities at metro stations and metro expansions beyond the city, including the link to Schiphol Airport.

Besides these efforts to improve accessibility, Rotterdam also prioritizes the environmental aspects of their transport systems. The Dutch taxation and subsidy program encourages electric vehicle usage and drives investments in charging facilities. Rotterdam is also a member of 100 Resilient Cities, which incentivizes initiatives to improve air quality in the city, for example, by the creation of low emissions zones in major parts of the city.

Overall
25th

People
14th

Planet
26th

Profit
37th

ZURICH

Zurich is the largest city in Switzerland, providing a home to 415,000 people, significantly more than the official capital Bern. The number of residents is exceeded by the number of people working in Zurich (450,000) and by the population of the metropolitan region Zurich (over one million). One in eleven jobs is located in the Helvetian city, which presents challenges to the city's transportation network as people need to get to work from within and outside the city borders.

To meet these challenges, in 2012 Zurich's local government devised the Strategien Zurich 2025, which provides a framework for long-term sustainable development, including an overarching mobility plan. Although Zurich is well-connected through widely branched and modern public transportation, the use of private cars creates significant traffic stress.

The city's mobility strategy centers on the expansion of the public transportation network and improving its upkeep and access. While trams, buses, city trains, and even ships and cableways already form a tight and efficient public transportation network, there is still room for further development. More tram and train lines are planned, and the entire network of the Züricher Verkehrsbetriebe will be expanded with the construction of additional lines. Other measures designed to improve the environmental sustainability of the system include replacing diesel buses with trolleybuses and supporting car-less households.

In this light, developing the cycle network is an essential task. More cycle parking areas are being created, complemented by new guidance systems and efforts to reduce traffic dangers to cyclists.

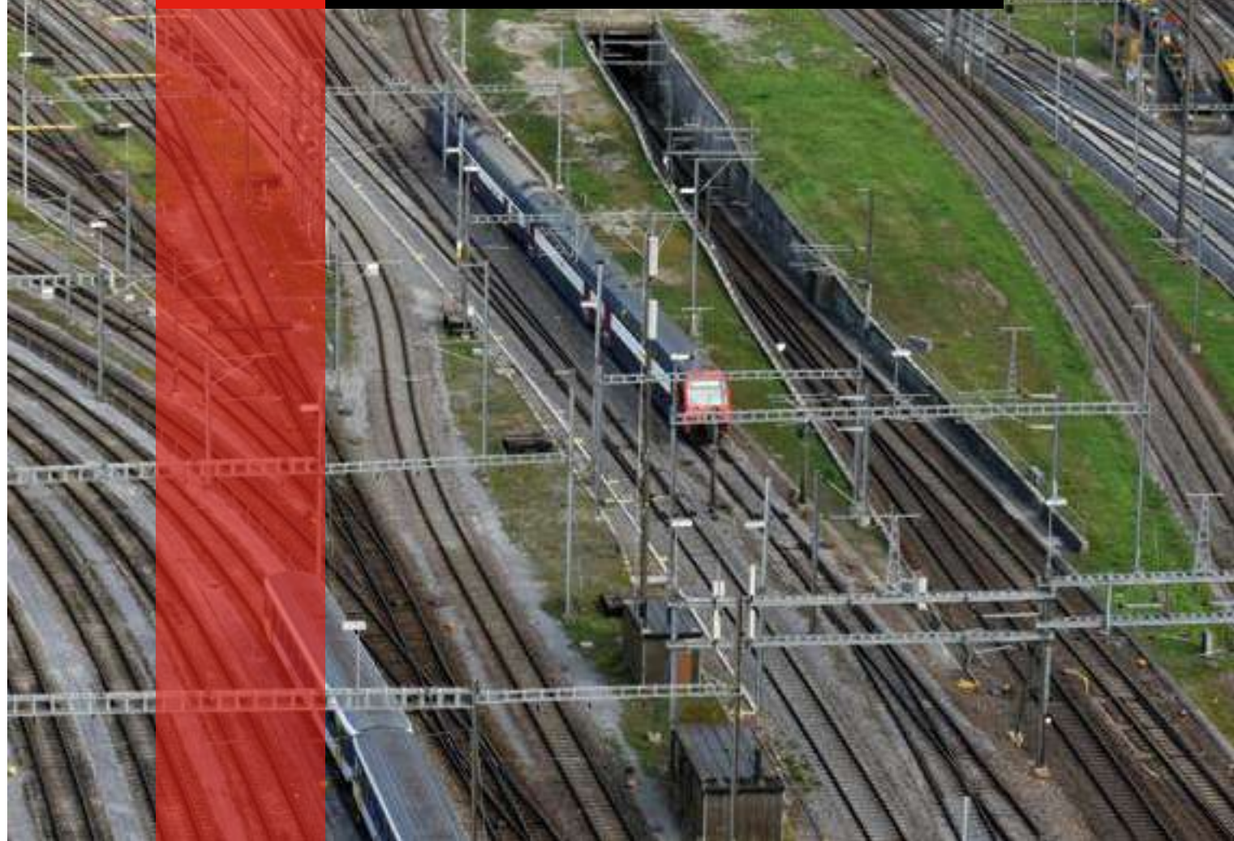
A visionary part of the mobility strategy is the project Cargo sous terrain. A subterranean logistics network will transport goods between Swiss economic centers via a network of tunnels. Reloading hubs in the cities will ensure distribution of the goods by autonomous vehicles.

Overall
2nd

People
45th

Planet
7th

Profit
1st



Overall
47th

People
27th

Planet
24th

Profit
96th

SÃO PAULO

São Paulo is the main Brazilian financial center and has the tenth largest GDP in the world. Despite its economic importance, the challenges that São Paulo faces are typical of a city that has grown without planning: high living costs push the poorest among the population to the suburbs, while commerce and jobs are concentrated downtown, forcing people to travel long distances every day.

The majority of daily travel in São Paulo is made by car or motorcycle, leading to traffic congestion and delays. Since 2013, the city has prioritized public transportation, by investing in in the implementation of exclusive bus lanes (increasing the system reliability), bike lanes and new metro lines. The metropolitan extension will provide connectivity to Guarulhos Airport.

With São Paulo's 11+ million residents, the city should consider a polycentric scheme, with strategies that include urban and social development in strategic public transportation corridors outside downtown areas, discouraging car use by improving cycling lanes and creating a more pedestrian-friendly city.

In a recent São Paulo Mobility Survey, 83 percent of citizens who own a car – 2.3 million people – are willing to leave it in the garage if a better public transportation option is offered. Public transportation is the key to making São Paulo a more sustainable city.

NORTH AMERICA

CHICAGO

Overall
49th

People
20th

Planet
68th

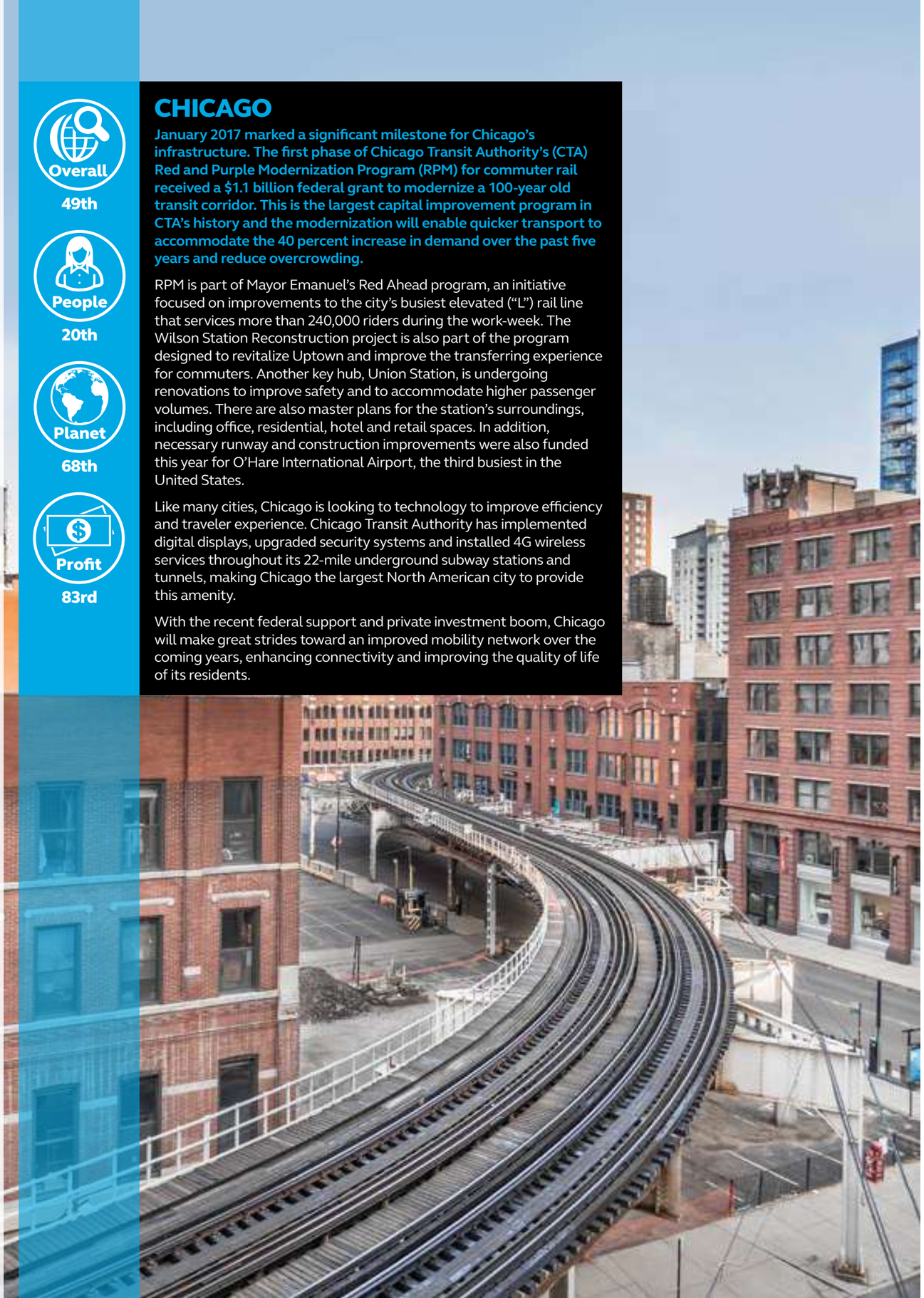
Profit
83rd

January 2017 marked a significant milestone for Chicago's infrastructure. The first phase of Chicago Transit Authority's (CTA) Red and Purple Modernization Program (RPM) for commuter rail received a $1.1 billion federal grant to modernize a 100-year old transit corridor. This is the largest capital improvement program in CTA's history and the modernization will enable quicker transport to accommodate the 40 percent increase in demand over the past five years and reduce overcrowding.

RPM is part of Mayor Emanuel's Red Ahead program, an initiative focused on improvements to the city's busiest elevated ("L") rail line that services more than 240,000 riders during the work-week. The Wilson Station Reconstruction project is also part of the program designed to revitalize Uptown and improve the transferring experience for commuters. Another key hub, Union Station, is undergoing renovations to improve safety and to accommodate higher passenger volumes. There are also master plans for the station's surroundings, including office, residential, hotel and retail spaces. In addition, necessary runway and construction improvements were also funded this year for O'Hare International Airport, the third busiest in the United States.

Like many cities, Chicago is looking to technology to improve efficiency and traveler experience. Chicago Transit Authority has implemented digital displays, upgraded security systems and installed 4G wireless services throughout its 22-mile underground subway stations and tunnels, making Chicago the largest North American city to provide this amenity.

With the recent federal support and private investment boom, Chicago will make great strides toward an improved mobility network over the coming years, enhancing connectivity and improving the quality of life of its residents.



LOS ANGELES

Overall
72nd

People
60th

Planet
67th

Profit
94th

Traffic congestion is one of the biggest day-to-day challenges for Los Angeles's residents, with the average person spending 104 hours stuck in traffic each year. The city is forecast to add an additional 500,000 residents over the next two decades, adding stress to roads and highways. In 2016, the city reached a critical milestone, when voters approved Measure M, an LA county-wide sales tax ballot that will fund much needed infrastructure improvements.

Such funding includes projects like the Los Angeles Metropolitan Transit Authority's (Metro) Active Transportation Rail-to-River Corridor, which aims to transform 10.6 miles of an underutilized rail area into a safe pedestrian and bicycle passageway. Metro is continuing its transit efforts with Regional Connector, a 1.9-mile alignment between two key stations downtown, as well as the Purple Line Extension, a nine-mile high-speed rail network that provides an alternative to congested roadways.

Digital technology offers opportunities; Metro recently announced a revamping of its fare payment system, TAP, to include app development, so commuters can easily reload funds through smartphones. E-signs, such as bus signage and wayfinding alerts, are also being implemented throughout the city, with the aim of streamlining trip experience and encouraging transit ridership. The Ports of Long Beach and Los Angeles have incorporated automation technology into their terminals to process container shipments faster, while minimizing safety risks and lessening the environmental impact of emissions and greenhouse gases.

Los Angeles is a pioneer in the use of electric vehicles. Its initiatives include providing 1,300 charging stations, designing the nation's first EV car share program for low-income residents, and creating the nation's largest EV police force fleet, demonstrating the city's commitment to sustainability.

Overall
23rd

People
2nd

Planet
36th

Profit
77th

NEW YORK

New York City has some of the most intricate transportation networks in the U.S. and they are increasingly under strain from an expanding population, limited space, aging infrastructure and a booming economy. Key to preserving the lifeblood of New York is its connection to New Jersey, from which 400,000 residents commute into Manhattan daily to work, making transit efficiency between the two an imperative.

The Port Authority of New York and New Jersey has so far had an eventful 2017, undertaking two major airport projects. Newark Liberty International Airport broke ground on the $2.4 billion renovation of Terminal A, a project that will include new bridges, a car park and interior modernization to accommodate more passengers. Improvements to LaGuardia Airport are also underway, including a $4 billion unified terminals program, which will update insufficient facilities and provide greater capacity to meet record-breaking passenger volumes. The Authority also approved a $32.2 billion capital plan at the beginning of the year for bus terminal improvements, as part of a ten-year infrastructure strategy.

An affordable ferry service launched this year. In the future, New York is planning additional programs, such as the Gateway Program, to increase track, tunnel, bridge and station capacity between Newark, New Jersey and Penn Station, New York, a key economic corridor through which New Jersey residents commute to and from the city.

Even with these improvements, New York is still faced with major challenges to ensure its infrastructure reaches the necessary levels. A continued focus on design-build, private finance and technology are all vital for the future. For instance, the Metropolitan Transportation Authority (MTA) is implementing an enterprise asset management program to optimize asset data tracking for lower operational costs, while enhancing safety and reliability. New York leads North America in the Index. But it is also a city with a lot to lose if its planned major infrastructure projects are postponed.

UNITED KINGDOM

Overall
38th

People
58th

Planet
37th

Profit
25th

BIRMINGHAM

From the original London-to-Birmingham railway, to the city's canals, the world-famous Spaghetti Junction and Birmingham International Airport, transport has long shaped the identity of England's second city.

Yet, with so much now changing for the better in Birmingham, the city's transport network will once again need to be the core driver of its economic success. Global businesses are now moving operations into the city on a large scale and highly skilled workers are relocating to Birmingham, in pursuit of a better quality of life.

Where there is growth there is always risk. Traveling across the city at peak time highlights the problem of overcrowding and, in particular, road congestion. The New Street station is the busiest outside of London and travel times around the wider West Midlands region area can be a challenge.

Productivity in the West Midlands remains lower than it should be. Given the region's position at the heart of the government's new Industrial Strategy, much more needs to be done to reduce congestion and travel time.

That said, city leaders understand the issues at stake and investing in mobility is a key priority. As an example, the newly appointed West Midlands Mayor is involved in the conversion of the old Curzon Street station into Birmingham's state-of-the-art high speed rail hub.

Overall
17th

People
17th

Planet
22nd

Profit
28th

EDINBURGH

The Scottish capital is the United Kingdom's fastest growing city and the largest British financial center after London. Close alignment with the London financial markets means that the success of these two cities often goes hand-in-hand and rail and air links between the cities are vital to Edinburgh and the wider Scottish economy.

Edinburgh attracts thousands of tourists from around the world and the quality of life, together with its attractive aesthetic and prestigious educational establishments has fueled popularity with inward investors and have made the city a leading hub for digital entrepreneurs. Edinburgh's universities draw students and staff from around the world and good air links to international hub airports are vital to support the ongoing growth of these major institutions.

As with many European cities in recent years, Edinburgh's growing population has placed increasing pressure on its transport network and Edinburgh was recently named amongst the most congested cities in the United Kingdom. Recognizing this, a plan has been formulated to build a truly world class and integrated transport system, by updating aging infrastructure and extending the recently completed tram line. The roads connecting to the city will be improved with the opening of the Queensferry Crossing, along with recent improvements to the M8 to Glasgow and planned reconstruction of the A9 to improve journeys north to the Highlands.

To improve quality of life in the city center, active travel must be encouraged and the city's stretched transport infrastructure upgraded to better connect people to jobs and opportunities. The planned tram extension will improve links to the east of the city and seek to work in harmony with the growing cycling community.

Overall
7th

People
10th

Planet
8th

Profit
17th

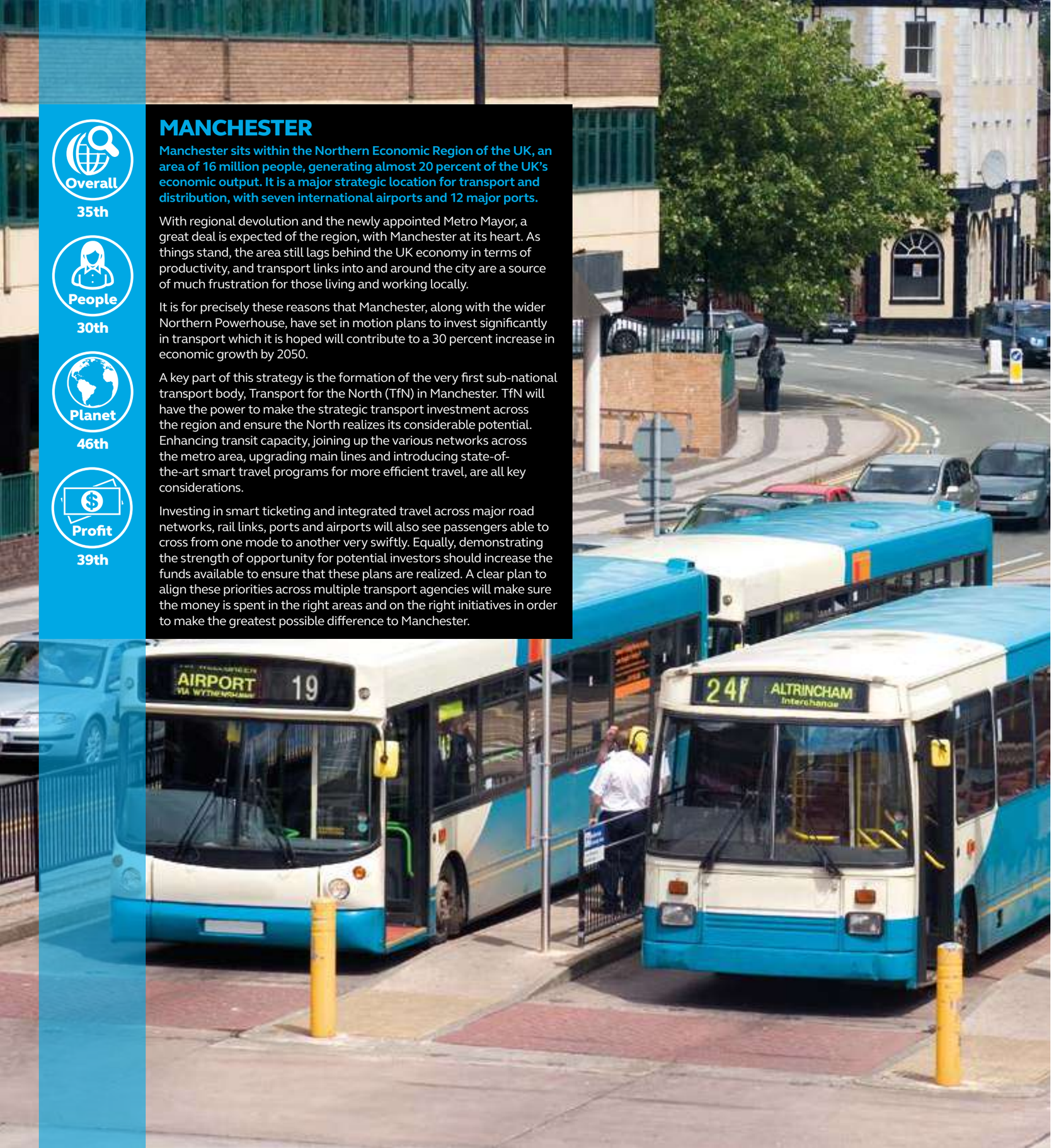
LONDON

London is a city of transportation firsts: the world's first underground railway network; the world's first under-river tunnel; the world's first international airport and the world's first fully orbital ring road. London can be proud of its tradition of pioneering transportation and mobility infrastructure. Yet if the city is to be as transformed by the digital revolution in the 21st century as it was by the industrial revolution in the 19th, it must invest, adapt and, above all, innovate.

To have an edge on the competition, London must enable millions of people to travel daily in, out and around the city. It must create a high capacity, reliable, low cost and integrated transport network, all without disrupting day-to-day travel.

The network must be conducive to growth and receptive to rapidly emergent technology and it must support the increasingly polycentric nature of the city. Many of the developments necessary to achieve these goals are underway: HS2 with stations in Euston and Old Oak Common will increase capacity, drive regeneration and create new quarters in the city; Thames river crossings will increase connectivity and enable freer traffic flow; Crossrail will connect new areas of the city currently blighted by their isolation; and increased capacity at all five of London's airports will maintain the city's status as a global hub.

The question is, will London be reactive or boldly proactive? The long-awaited London plan must set a clear, far-sighted and integrated strategy. It needs to underwrite a vision for the future with a clear approach to mobility that catapults London into the 21st century and ensures economic productivity and sustainability.



Overall
35th

People
30th

Planet
46th

Profit
39th

MANCHESTER

Manchester sits within the Northern Economic Region of the UK, an area of 16 million people, generating almost 20 percent of the UK's economic output. It is a major strategic location for transport and distribution, with seven international airports and 12 major ports.

With regional devolution and the newly appointed Metro Mayor, a great deal is expected of the region, with Manchester at its heart. As things stand, the area still lags behind the UK economy in terms of productivity, and transport links into and around the city are a source of much frustration for those living and working locally.

It is for precisely these reasons that Manchester, along with the wider Northern Powerhouse, have set in motion plans to invest significantly in transport which it is hoped will contribute to a 30 percent increase in economic growth by 2050.

A key part of this strategy is the formation of the very first sub-national transport body, Transport for the North (TfN) in Manchester. TfN will have the power to make the strategic transport investment across the region and ensure the North realizes its considerable potential. Enhancing transit capacity, joining up the various networks across the metro area, upgrading main lines and introducing state-of-the-art smart travel programs for more efficient travel, are all key considerations.

Investing in smart ticketing and integrated travel across major road networks, rail links, ports and airports will also see passengers able to cross from one mode to another very swiftly. Equally, demonstrating the strength of opportunity for potential investors should increase the funds available to ensure that these plans are realized. A clear plan to align these priorities across multiple transport agencies will make sure the money is spent in the right areas and on the right initiatives in order to make the greatest possible difference to Manchester.

6.0 APPENDICES

METHODOLOGY:

The Mobility Index is constructed with a three-stage averaging process to create a composite score and corresponding ranking for each of the 100 cities.

The overall Index score for each city is based on the city's performance in 23 individual indicators listed in Appendix II. For each indicator, the same set of steps is followed which allows us to assign a value between 0 percent and 100 percent to each city:

- Firstly, in each indicator, raw scores are found for each city. For example, in the modal split indicator, the percentage of all trips taken by public transport is given for each of the 100 cities on the Index.
- All raw scores are compared and the standard deviation for the statistical dataset is computed. To account for outliers, each data point is checked to determine if it falls outside of 2 standard deviations (s.d.) from the mean. If a data point for a specific city does fall outside the mean +/- 2 s.d., the city is assigned a value equal to either the mean +2 s.d. or the mean – 2 s.d.
- To calculate an Index score for each city, a minimum-maximum approach is used to assign a city a score between 0 percent and 100 percent. The lowest scoring city (after accounting for outliers) is assigned a score of 0 percent and the highest scoring city is assigned a score of 100 percent. All city scores in between the minimum and the maximum are assigned a proportional score specifically using the formula (data point – series min) / (series max – series min).
- Given that a higher overall Index score indicates a better performance, for indicators where a lower figure is deemed positive (such as traffic fatalities), the inverse of the data point or its negative equivalent were used.
- In the rare case that a data point for a particular city was not available, the average score of the indicator was used in its place.

Once scores between 0 percent and 100 percent were assigned to each city in each indicator, the individual indicators are then grouped into one of three broader sub-indices – People, Planet and Profit. Of the 23 individual indicators, 10 sit within the People sub-index, seven within Planet, and six within Profit.

The People sub-index measures the social and human impacts of the city's mobility system, such as coverage of the transport network and wheelchair accessibility, efficiency and upkeep of a metro system, and digital capabilities on the city's trains and buses.

The Profit sub-index assesses the economic aspects of a city's mobility system. This encompasses key metrics for commuters, such as time taken to get to work and affordability of the public transport network, as well as the city's financial commitment to their transport infrastructure.

The Planet sub-index measures the environmental implications of the city's mobility system, including metrics such as air pollution, greenhouse gas emissions, electric vehicle incentives, and green space.

A weighting system is applied to the calculation of sub-index scores. To determine the weightings, the individual indicators are ranked from most important to least important in terms of how appropriate and reflective the indicator is as a metric for urban mobility. The most important metric is then assigned the highest weighting while the least important receives the lowest. The weights for the variables in between are spread evenly. To see the highest to lowest rankings for each indicator, please see Table 2.

After sub-index scores were calculated for each of the 100 cities, a simple average is taken of all three to create the final Index scores and rankings.

INDICATORS

Table 1 - List of indicators used in the Sustainable Cities Mobility Index

	INDICATOR	UNIT	SOURCE		DATA LEVEL	FURTHER EXPLANATION
People	Fatalities	Traffic fatalities per 100,000 inhabitants	National Safety Council, Eurostat, WHO, various		Mostly city level (exceptions include China and Australia)	Traffic safety is of utmost importance and fatalities can be indicative of an under-served or under-maintained system.
	Access to Transport Services	Bus and metro stops per km2	European Metropolitan Transport Authorities (EMTA), EPOMM, various		City	Accessibility of transport services heavily impacts how utilized they are by the residents of a city.
	Modal Split of Trips Taken	Share of total trips taken by public transport	European Metropolitan Transport Authorities (EMTA), various		City	A higher number of trips taken by public transport recognizes utilization. The higher the utilization, the better.
	Rider Connectivity	Wi-Fi in metro tunnels, stations and on buses, 2g/3g/4g in metro stations and tunnels	Various including local transport provider websites and news publications		City	Wi-Fi and 2/3/4g service within the transport system makes travel easier as well as more enjoyable and productive by allowing residents to use devices seamlessly during their journey.
	Upkeep of the Metro System	Year of last major improvement; defined by track expansion or station additions	Various including local transport provider websites and news publications		City	Track and station additions assist in making use of the metro system easier for residents.
	Wheelchair Access	Share of buses and metro stations that are wheelchair accessible	Various including local transport provider websites and news publications		City	Transport accessible to all boosts quality of life for residents.
	Uptake of Active Commuting	Share of commuters cycling or walking to work	EMTA, EPOMM, Various		City	The ability to cycle or walk to work is reflected in the number that choose to do so each day. Active commuting has many benefits to residents.
	Transport Applications and Digital Capabilities	Availability of transport system on Google Maps, an app created by the transportation authority, and existence of digital ticketing	Various including the Observatory of Automated Metros		City	Incorporation of digital capabilities into a transport system makes using public transport easier in cities.
	Airport Passengers	Annual passenger traffic	ACI Airport Statistics		City	Airport traffic reflects the ability to get in and out of a city via plane.
	Hours of Metro Accessibility	How many days a week the metro operates 24 hours	Various including information pages of local transport providers		City	24-hour accessibility in metro systems allows for greater use and flexibility for people. Cities without a metro system are penalized here, as metro systems are quick, easy and efficient. Often, the most sustainable form of public transport currently available to cities.
Planet	Transport Greenhouse Gas Emissions	Metric tons of CO2 per capita multiplied by CO2 from Transport	CDP Cities		City (Metric tons of CO2 per capita) x National (CO2 from transport)	This includes city data on all sources of emissions adjusted with national data on share of emissions resulting from transport.
	Provision of Green Space	Green space as share of city area	Siemens Green City Index, World Cities Culture Forum, European Environment Agency		City	Greater use of public transit relieves the need for roads and parking, which can subsequently be turned into green space. Green space also helps counter the emissions from transport.
	Congestion and Delays	Increase in overall travel time	TomTom, Numbeo		City	This measures the average increase in travel time from a free-flow situation to peak hours. Greater congestion leads to greater emissions and pollution.
	Bicycle Infrastructure	Bicycles per capita and bicycle sharing schemes	MetroBike		City (sharing schemes) National (bike ownership)	Bicycle sharing schemes and ownership help alleviate road traffic and congestion.
	Air Pollution	PM10 levels (ug/m3) / PM2.5 levels – simple average	WHO Global Urban Ambient Air Pollution Database		City	This includes all sources of pollution. Transport does account for a critical share of pollution.
	Efforts to Lower Transport Emissions	Existence of LEZs and their prevalence (Cebr score) and vehicle emission standards	Various including European Commission's Urban Access Regulations website		City	Low emission zones impact pollution as do high emission standards. This is a critical part of city and national policy to ensure environmental sustainability.
	Electric Vehicle Incentives	Provision of incentives to produce/ purchase EVs	Various including government transport department websites		City	Encouraging residents to switch to Electric Vehicles is an essential step in ensuring a lower emissions future.
Profit	Commuting Travel Time	Average commuting time	Numbeo Traffic Index		City	Additional time spent commuting is less time to contribute to economic activity.
	Economic Opportunity	Transport system revenues as a share of expenses	Various including annual reports of transport providers		City	A city's ability to fund transport system needs through revenue is critical to its sustainability.
	Public Finance	Share of city budget spent on transport	Eurostat, city budgets		City	Many transit system upgrades are financed through multiple sources of funding, private, federal, state and city budgets. City budgets should still contribute to infrastructure needs and is indicative of its commitment to sustainable mobility.
	Efficient of Road Networks	Max city speed limit	AA, Auto Europe		City	The more efficient the road network, the higher the speed limit can be set. There was no correlation between this indicator and the fatalities indicator in the People pillar.
	Affordability of Public Transport	Transport spending as a percentage of income	Numbeo, Expatistan		City	Refers to price of regular monthly pass for public transport as a proportion of average monthly net earnings in city. Affordability is a key factor in resident's usage.
	Utilization of the Transport System	Average number of public transport journeys per capita	Land Transport Authority Singapore, American Public Transport Association, various		City	A higher number of trips taken by transport recognizes utilization per capita. Higher usage also allows greater revenue capture from fares for a city.

WEIGHTINGS AND RATIONALE

Table 2

	PEOPLE INDICATOR AND WEIGHTING	RATIONALE	PLANET INDICATOR AND WEIGHTING	RATIONALE	PROFIT INDICATOR AND WEIGHTING	RATIONALE
HIGHEST WEIGHTING	Modal split of trips taken – 16%	We want to encourage public transport use and this is the most direct measure of that.	Greenhouse gas emissions – 17%	A key environmental measure and now overlaid with share of emissions based on transport.	Utilization of the transport system – 30%	Very important that the system is commonly used so top indicator.
	Fatalities – 15%	Safety is a key feature of a good transport system.	Efforts to lower transport emissions – 16%	Cities that are the most proactive should be rewarded.	Public finance – 25%	Measure city's financial commitment which is critical even when considering alternative funding schemes.
	Access to transport services – 13%	Very important as better access makes it much more likely that people will be using the system.	Congestion and delays – 15%	Key contributor of pollution.	Affordability of public transport – 19%	Greatly impacts daily life and utilization and popularity of the system.
	Uptake of active commuting – 12%	Has positive implications for the environment and personal health.	Bicycle infrastructure – 14%	Important for some cities, but not a priority for others.	Commuting travel time – 14%	Greatly impacts daily life in the city.
	Transport applications and digital capabilities – 11%	Important, but it is still possible to run a decent system without having many digital capabilities.	Electric vehicle incentives – 13%	Forward-thinking metric, which could have major implications.	Economic opportunity - 9%	Indicative of financial sustainability of the system.
	Rider connectivity – 9%	Makes traveling more pleasant and efficient, but not a 'must-have'.	Provision of green space – 13%	Important in counteracting negative impacts but not as transport-specific.	Efficiency of road networks – 3%	Only measures speed limits, which are less important than the other measures.
	Upkeep of the transport system - 8%	Relates to metro; ongoing major updates.	Air pollution – 12%	Important measure, but not as transport-specific.		
	Airport passengers – 7%	Doesn't necessarily impact daily life.				
	Wheelchair access – 5%	Important, but doesn't impact entire population.				
LOWEST WEIGHTING	Hours of Metro Accessibility – 4%	Most cities have all day coverage and some night time coverage 24/7 service is practical and nice to have, but not essential.				

DISCLAIMER

While every effort has been made to ensure the accuracy of the material in this document, neither the Centre for Economics and Business Research Ltd nor Arcadis will be liable for any loss or damages incurred through the use of this report.

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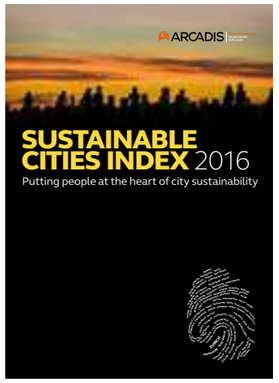
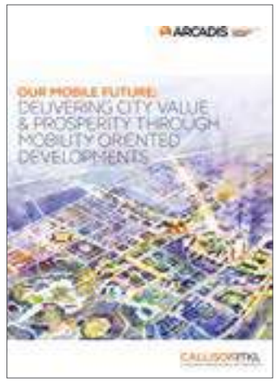
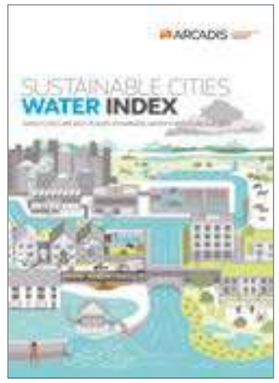
7.0 FURTHER READING



SUSTAINABLE CITIES INDEX 2016



OUR MOBILE FUTURE



SUSTAINABLE CITIES WATER INDEX

DRIVERLESS FUTURE

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