

In collaboration with the Boston Consulting Group
and the University of St Gallen, Switzerland



How Mobility Shapes Inclusion and Sustainable Growth in Global Cities

WHITE PAPER
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Foreword



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Access is an essential prerequisite for social equity and prosperity. To take full advantage of the opportunities available in a society, they must be accessible to as many people as possible. Mobility is a crucial requirement for accessibility and, in turn, for socio-economic growth. Jobs and education, as well as other social and cultural services, can only be delivered equitably across a society when everyone has the mobility to easily access these essential facets of well-being.

But mobility solutions are still far from equitable in many regions, and the COVID-19 pandemic has further amplified the problem. One reason for this may be a lack of powerful empirical approaches to reveal the influence of specific mobility measures on social inclusion.

This White Paper, a joint effort between the World Economic Forum, the Boston Consulting Group (BCG) and the University of St Gallen, Switzerland, is a key milestone in finding a data-driven analytical approach to investigate and measure the impact of mobility on social equity. The travel demand model used in this research was developed by BCG Gamma and relies on standardized dimensions of inclusivity defined by the Forum. BCG Gamma also created urban area digital twins and simulation scenarios. This model allowed for measuring the degree of mobility inclusivity in three archetypical cities and the impact of potential policy levers in

them. Throughout the process, the University of St Gallen assured the validity and meaningfulness of these modelling results and added qualitative perspectives by conducting a number of interviews.

Social inclusivity was simulated using indicators ranging from a mobility systems' availability to its affordability, and from its performance and reliability to its safety and health metrics, including CO₂ emissions. The insights gathered were examined, discussed and tested in a qualitative research process that included many interviews as well as working groups involving over 50 representatives from governments, cities, public transit authorities, social organizations, academic institutions and private companies. This process was in line with the Forum's multistakeholder approach, which has proven to be essential in grasping the full ramifications of challenging issues and in generating successful solutions.

We hope this White Paper, a centrepiece of the multiyear, successful cooperation between the World Economic Forum and BCG accompanied by the University of St Gallen, inspires new and expanded efforts by public- and private-sector mobility organizations, policy-makers and experts to better understand which levers to apply to make mobility more inclusive and equitable. It's time for accelerated action.

Executive summary

As a joint project between the World Economic Forum, the Boston Consulting Group and the University of St Gallen, Switzerland, this White Paper aims to measure the effects of mobility on social inclusion to provide a methodology for modelling transportation equity. This paper defines social inclusion as the ability and opportunity for people and groups to take part in society through jobs, education and access to healthcare.

The access to reliable, safe and well-designed transportation systems and modes is among the most crucial factors in social inclusion and, as an important by-product, in slowing climate change. Three archetypical cities and their transportation ecosystems at different stages of maturity were examined: Chicago (USA), a car-centric city; Berlin (Germany), a compact middleweight city; and Beijing (China), a high-density megacity. The socio-economic and quality-of-life effects of different mobility policy solutions on population segments and city areas were explored through data-driven insights, simulations and qualitative analyses.

The research on these cities and dozens of others, as well as over 50 interviews with transport policy-makers and experts in the public and private sectors, led to five imperatives that public-sector policy-makers and transport industry executives must consider to shape mobility in a more equitable way:

- Access to transportation infrastructure is essential to social development and economic growth. Improving the mobility situation for underserved population groups needs to be one of the top priorities for decision-makers.
- To foster social inclusion through mobility, both supply and demand must be considered. Purely increasing mobility infrastructure does not always yield the desired results.
- Mobility systems should include more innovative, multimodal transportation solutions and eschew the cars/public transport binary perspective.
- Data collection processes and the current understanding of rider demand must be revisited and refined to gather more salient information about mobility challenges affecting minorities.
- Learnings need to be transferred to mobility pilots to validate findings and test user acceptance; new, non-obvious ways to finance inclusive mobility solutions need to be pursued.

One lesson is that simple mobility initiatives, such as adding first- and last-mile shuttles in Chicago, increased the number of jobs accessible to underserved communities by up to 90%. And with a scaled-up metro pass reservation system in Beijing, in which people can pre-book their slot on a train and then bypass queues at the station to enter the train directly, the commuting times could be decreased by 29%. Further, in Beijing, by introducing a green travel Mobility as a Service (MaaS) platform served by scooters, bikes and electric vehicles, among other public transit initiatives, CO₂ emissions were reduced by 12%. And in Berlin, a differentiated service level on public transit, similar to a business-class carriage on trains, increased the share of public transit trips by 11% while at the same time generating 28% higher revenue for the public transport operator.

A six-step transportation equity methodology was designed to analyse the three cities – the mobility challenges they face, their affected communities and how transportation is driving (or failing to drive) economic growth and well-being – and to produce workable mobility recommendations that result in real gains. This methodology fills a void in current transportation analysis and can serve as the centrepiece of a strategy for developing mobility-based social inclusion programmes and policies for any region.

The methodology's six steps are: 1) applying a solutions framework comprised of over 40 possible inclusive mobility approaches; 2) baselining the cities' social inclusion status quo; 3) identifying pain points; 4) delineating affected population centres in a data-driven approach; 5) specifying pilot solutions; and 6) generating calls to action.

This White Paper shows that social inclusion propelled by mobility improvements is a significant issue that has not yet garnered sufficient attention, much less sufficient action. Many policy-makers do not know where to begin to implement a programme that is earmarked for success. The methodology in this paper provides a roadmap for transportation stakeholders in the public and private sectors to rally as a global community, to adjust current practices and to start initiating rigorous, quantitative and logical approaches to mobility-driven social inclusion.

1

Mobility as the path to social inclusion

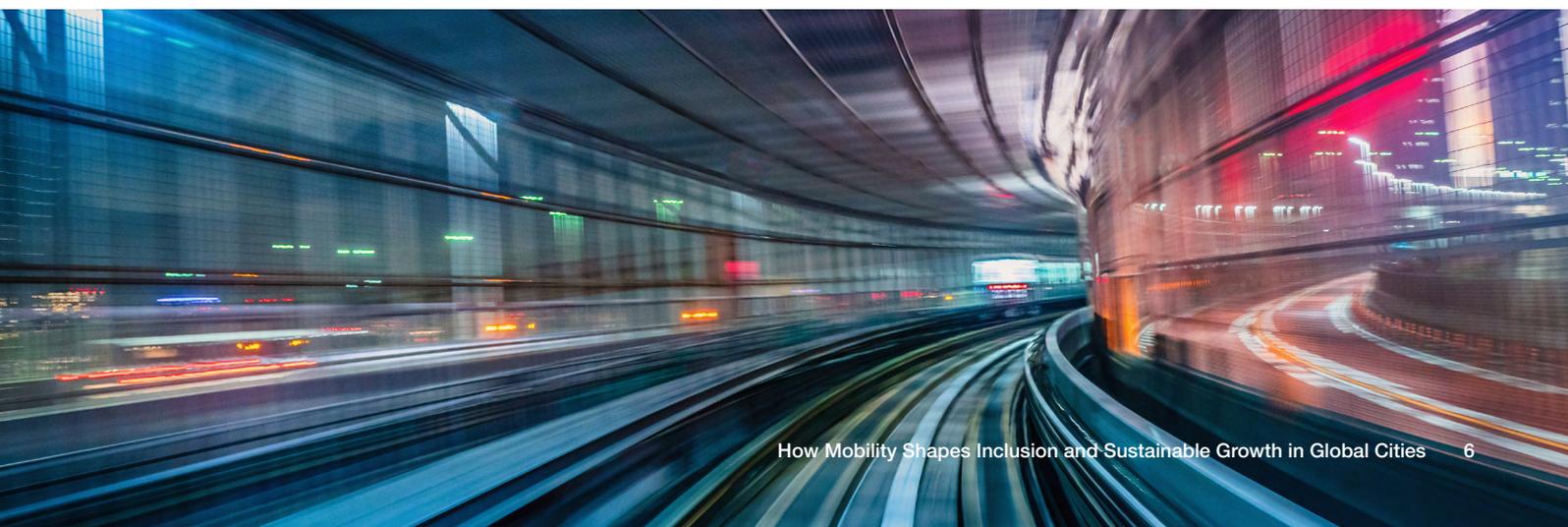


Transportation is a crucial factor in social inclusion, a broad term that describes the ability and opportunity for people and groups to take part in society. For instance, studies have found that shorter commuting times are a reliable indicator of an individual's ability to escape poverty. And during the last two years, as the COVID-19 pandemic raged globally, people living in mobility deserts (areas with constrained mobility access) were disproportionately vulnerable to the virus. Because of their distance from healthcare facilities and lack of access to transportation, they were unable to get tested regularly or take advantage of early vaccine rollouts, as evidenced by outcomes in the United Kingdom, where the slowest vaccine penetration was in areas with the most limited transportation networks.¹

Yet, while social inclusion is directly influenced by the availability of transportation, mobility decision-makers have difficulty keeping pace with needed changes that would broaden their systems' physical and socio-economic reach. It is widely recognized now that public transport riders are diverse in terms of gender, race, ethnicity, language, physical ability, financial means and age, and are travelling at all hours to jobs and other important destinations rather than primarily at rush hour. Yet, by and large, mobility systems look and function the way they did in the 1950s, when they served a radically different society. Most transport policy-makers still think of transportation in a binary manner, with cars on one side and mass transportation on the other. This myopia is especially troubling in an era when new technologies are emerging or are about to emerge, including on-demand shuttles, shared mobility apps and autonomous vehicles, to name just a few, that radically extend the contours of transportation.

To explore these and other shortcomings, to generate solutions for making transport systems more responsive to community needs and to serve as a lever for socio-economic growth, the World Economic Forum, Boston Consulting Group (BCG) and University of St Gallen, Switzerland, conducted an in-depth study of global mobility systems of all sizes and types and interviewed over 50 transport policy-makers and experts in the public and private sectors. This research identified five imperatives that decision-makers and practitioners in the transport industry must consider to shape mobility in a more socially inclusive fashion:

- 1. Equitable access to ample and effective mobility options for each community is an essential precursor to social development and economic growth.** For instance, adding new transportation modes, such as first- and last-mile shuttles and inexpensive ride sharing, can almost double the number of jobs accessible to individuals.
- 2. Both supply and demand need to be considered; many transportation managers mistakenly focus only on increasing supply.** Adding 10 new subway cars may do little to increase ridership among people generally turned off by public transportation. Creating a business class for public transit, however, almost always increases usage and brings in additional revenue that can be used to improve public mobility systems for the underserved.
- 3. Mobility systems must become more innovative and multimodal, replacing the cars/public transport binary perspective.** A successful multimodal transportation system requires a broad effort to create transportation infrastructure and policies that expand definitions of public transportation to include new mobility public-private partnerships that could revolutionize how people get around. Moreover, only creative answers will address mobility's role in the acceleration of climate change.
- 4. Data collection processes need to be improved, and rider demand patterns must be given more attention.** This allows to fully understand the mobility challenges of all residents. Without that, the possible return on investment for transportation infrastructure initiatives, as well as the effectiveness of deployment strategies for new mobility technologies, is limited.
- 5. Mobility pilots must be frequently employed and encouraged by stakeholders.** Only by testing and learning from real situations can impactful solutions be developed that will improve life in underserved communities. This also requires rethinking financing and funding options for these solutions.



Cities are embracing mobility innovation

The good news is that many places around the world are already applying these five imperatives or some version of them. Over the last few years, several countries and cities have recognized the urgency of tackling the systemic gaps in their transportation

systems and democratizing access to movement, hoping to create more equitable economic development opportunities and facilitate social progress. The initiatives illustrated in Figure 1 provide a glimpse into the breadth and creativity of some of the more inclusive new transportation programmes.

FIGURE 1 Innovative mobility solutions improve social inclusivity and sustainability



Source: World Economic Forum, University of St Gallen and BCG analysis

More details on some of these initiatives are provided in Figures 2 and 3:

FIGURE 2 Driverless minibus to help the elderly reach healthcare centres, Nishikata, Japan

KPI focus



Sustainability



Security



Inclusivity



Traffic reduction



Objective

- ✓ Offer mobility support to the elderly, given a lack of buses and taxis in rural areas
- ✓ Solve challenges arising from the inability to drive and younger generations moving out



Initiative

- ✓ Pilot in 2020
- ✓ Six-seater shuttles that travel at 10-40 kilometres (km) per hour in Nishikata, a rural city 115 km from Tokyo with over 6,300 inhabitants aged 65 or over
- ✓ Vehicle operational safety in all road conditions that includes navigating puddles and fallen debris



Enablers of success and challenges

- ✓ Increase inclusivity for the ageing population who lack mobility alternatives
- ✓ Ensure workability with the non-digitized population segment



Sources: DeNa, Japan; World Economic Forum, University of St Gallen and BCG analysis

FIGURE 3 | Cable car to mitigate congestion and support people with disabilities, La Paz–El Alto, Bolivia

KPI focus



Sustainability



Security



Inclusivity



Traffic reduction

 Objective

- ✓ Provide a safe and reliable alternative for the low-income, the disabled and women
- ✓ Increase affordability and decrease congestion and commuting times
- ✓ Reduce noise pollution

 Initiative

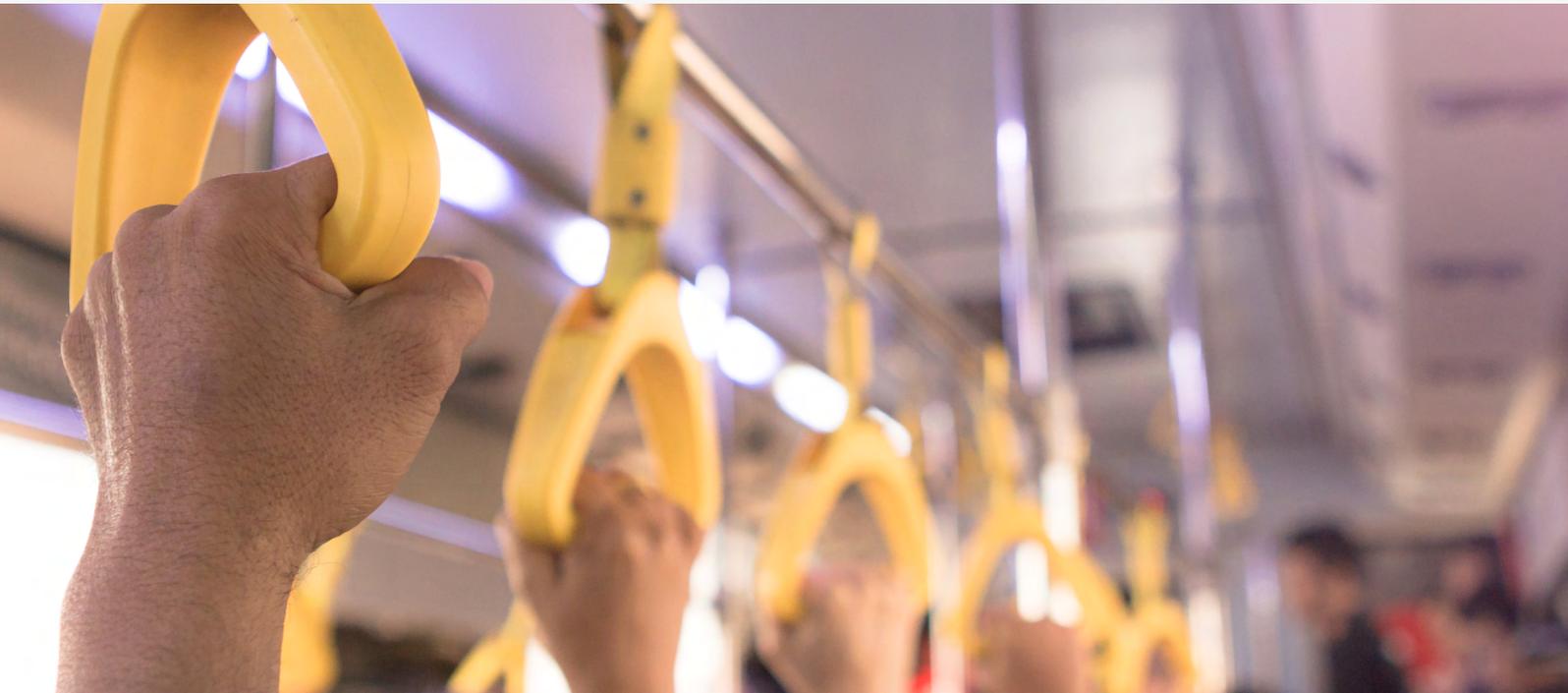
- ✓ Aerial cable car system that connects La Paz with El Alto in 20 stations along six routes, with plans to expand to 30 stations
- ✓ Cable cars that hold 10 passengers per cab, departing every 12 seconds, 17 hours a day
- ✓ Workforce that is trained to support people with disabilities in each station and ensure a safe environment for women

 Enablers of success and challenges

- ✓ Encourage inclusivity between low-income communities and other parts of the city
- ✓ Ensure constant functionality and cleanness on cable cars



Sources: Mi Teleférico, Bolivia; World Economic Forum, University of St Gallen and BCG analysis



A few patterns can be observed across the initiatives. First, several cities are emphasizing service to people with reduced mobility or physical disabilities. This research found, however, that transport systems designed to support individuals with intellectual or mental disabilities, non-native speakers of the region’s language, or cultural outsiders, are lacking, although they are also important. Second, while decision-makers who focus on improving public transit is a positive development, these efforts could create fresh challenges, such as overcrowded, unreliable and inefficient systems, especially in high-density megacities. Consequently, new mobility modes to complement public transit systems and serve riders

in parallel could be necessary to provide viable alternatives to cars. Third, cities are beginning to recognize the intersection between sustainability, social inclusivity and economic growth. To scale climate change initiatives to a meaningful degree, and to potentially access transportation financing options that may focus more on sustainability, decision-makers must design solutions that work to solve issues holistically.

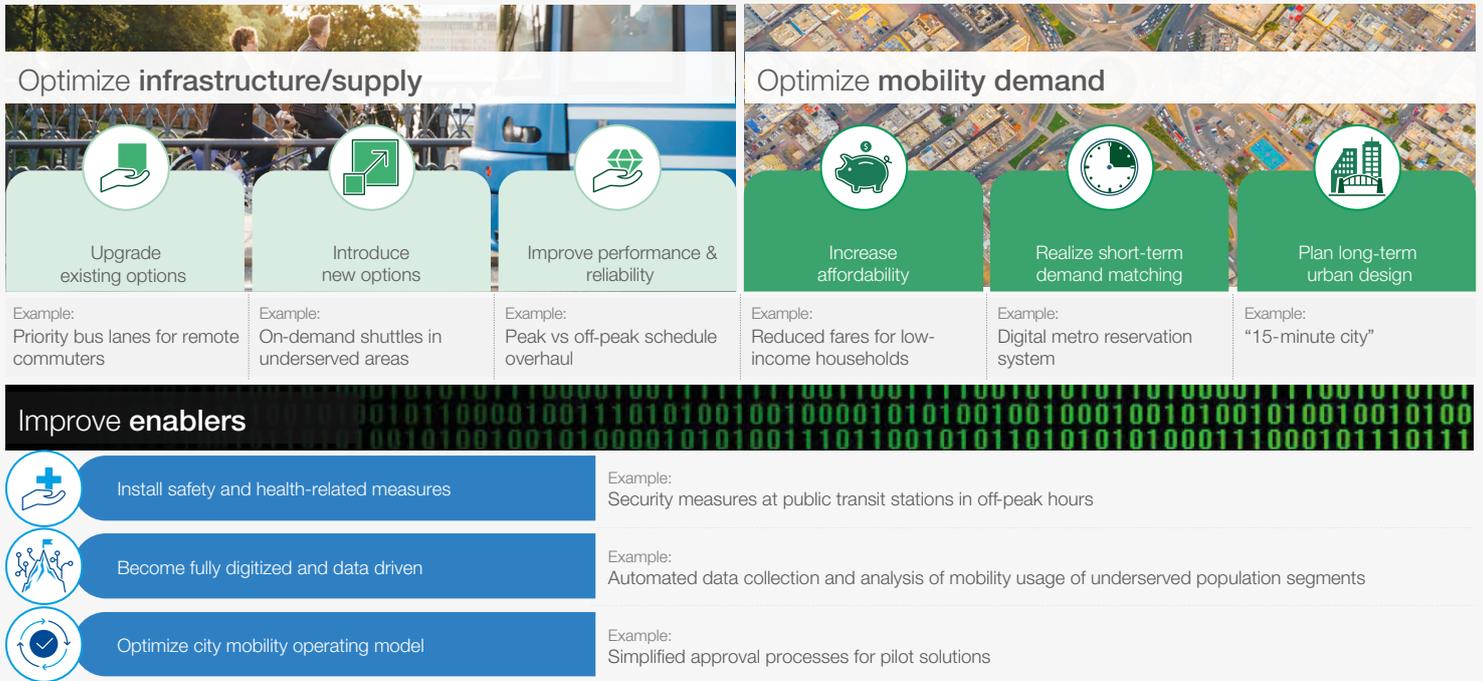
Based on quantitative and qualitative research, a universal inclusivity-centric framework was developed, comprising over 40 solutions that cities can pursue to optimize their existing mobility system and improve inclusivity.

These solutions are grouped into three categories (Figure 4):

- **Optimize infrastructure/supply:** expanding existing transport modes, introducing new modes, and improving performance and reliability of their systems

- **Optimize mobility demand:** increasing affordability, enhancing short-term demand matching, and improving urban design in the long term
- **Improve enablers:** enhancing systems' safety and health, becoming fully digitized, and optimizing the city mobility operating model.

FIGURE 4 Inclusivity-centric mobility solutions framework



Source: World Economic Forum, University of St Gallen and BCG analysis

A new social inclusion transport methodology

To provide a roadmap for mobility improvements that could lead directly to social inclusion and to test out the imperatives on a set of real cities, a new methodology for modelling transportation equity metrics was created (see the appendix). This methodology fills a void in current transportation analysis and can serve as the centrepiece of a strategy for developing mobility-based social inclusion programmes and policies for any region. The methodology was implemented in **six steps**:

1. The solutions framework was designed by collecting examples of more than 40 possible inclusive mobility solutions around the world. These solutions were targeted at optimizing transportation infrastructure or demand patterns within cities, as well as improving existing enablers where the opportunities to impact social inclusion are most amplified.
2. Three archetypal cities were identified – Chicago (USA), Berlin (Germany) and Beijing (China) – and digital twins were created to examine and baseline their status quo vis-à-vis transportation

and social inclusion. Since these are urban archetypes (car-centric, middleweight and megacity, respectively), the research findings are applicable to similar cities around the world.

3. Through interviews with more than 50 experts and data analysis, the cities were assessed for their transportation characteristics and the related pain points of underserved population segments.
4. Possible solutions to these pain points were determined by testing their efficacy using six specific key performance indicators (KPIs) and asking experts to comment on these results.
5. Different pilots, barriers to overcome and implementation strategies were analysed.
6. The potential results of the pilots were assessed, integrating the findings and offering policy-makers action items and ideas for future solutions.

To choose the KPIs for measuring the impact of mobility solutions, and to guide the choice of appropriate KPIs for each of the cities examined

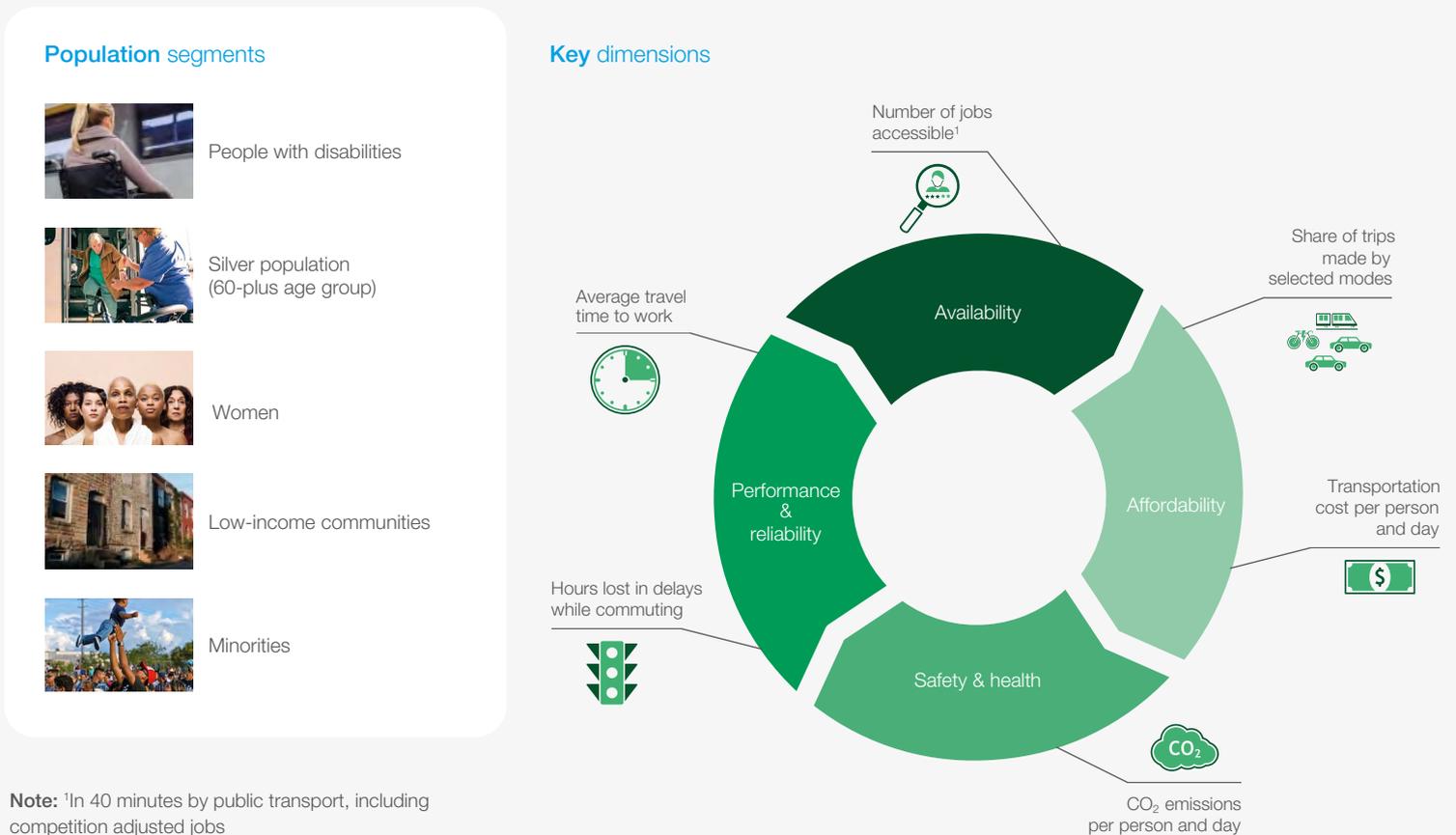
(see step 4 above), the World Economic Forum Inclusivity Quotient (IQ), launched in Davos-Klosters, Switzerland, in January 2020, was used. The IQ project was created to encourage equitable economic growth through mobility policy and technology and to standardize the notion of inclusivity so that it could be globally enforceable, with trackable success metrics and demonstrable impact. The IQ metrics include five dimensions for gauging the level of inclusivity of a mobility system:

- **Availability** comprises not only routes and the number of bus and train stops, but also the number of bus shelters and stations, job accessibility, policies for people with disabilities, and any other factor that would make a mode, product or service accessible.
- **Affordability** is concerned with the monetary cost to ride or drive, bearing in mind that the cost of a specific mode has direct consequences on the mode selected and thus on the share of trips made by mode; affordability may also include criteria such as the cost of equipment.

- **Performance and reliability** encompasses the average travel time to work and can be affected by factors like congestion or waiting times to transfer or board a mode of transportation.
- **Safety and health** includes crime rates on mobility modes as well as passenger complaints, perceptions of safety, verbal harassment and CO₂ emissions reduction policies.
- **Impact of digitization** is not a pure dimension with KPIs for measuring possible solutions on inclusivity, but is a qualitative metric that pertains to individuals who are unbanked, underbanked, disconnected from the internet, without a smart device, or lacking the skills or willingness to navigate complicated interfaces.

From these dimensions, and with the support of a group of experts from the public and private sectors, a long list of over 80 KPIs was derived and narrowed down to six that best measure the effect of possible solutions on inclusivity (Figure 5).

FIGURE 5 Five population segments and six KPIs to measure the degree of inequity



Three cities and their characteristics

Chicago, Berlin and Beijing were chosen as the first cities for the transportation social equity and inclusion analysis because these major urban centres' history and general city structure, as well as the maturity of their mobility systems, differ. Moreover, these cities each represent a specific [urban archetype](#), so that

other metropolitan areas with similar characteristics can rely on these analyses for their own mobility planning. One aspect these cities have in common is that, in each, inclusion solutions balancing transportation supply and demand better generated substantial positive economic outcomes and quality-of-life gains in the simulations.

1.1 The car-centric giant: Chicago, USA



Chicago is a unicentric city with a strong economic centre in the “Chicago Loop”, where the majority of high-paying jobs are concentrated. The poorest areas of the city are located south and west; the most affluent areas are concentrated in the north. Communities of colour tend to be concentrated in the less wealthy, under-resourced neighbourhoods.

While the city boasts a large public transportation system, including suburban buses (PACE), urban elevated trains (CTA) and an interurban rail system (Metra), Chicago is highly car-centric, with vehicles accounting for nearly 60% of transportation activities. With an average of 115 hours lost per year

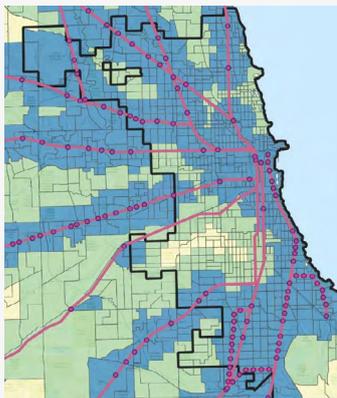
while commuting, Chicago ranks among the most transportation-congested cities in the United States.²

Chicago's segregated geography results in vastly different transportation experiences and pain points for its residents, with infrastructure and funding discrepancies resulting in worse service for poorer, underserved communities. It is difficult to address such systemic issues across a diverse landscape of involved stakeholders (CTA, PACE, Metra and the Regional Transportation Authority, among others). In addition, area coverage depends on incentives for providers (Figure 6).

FIGURE 6 Area coverage dependent on incentives for public transport providers

RTA¹: financial oversight, funding and regional transit planning

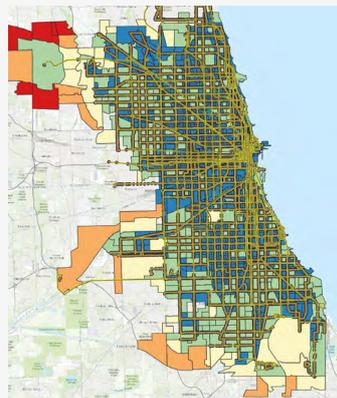
Metra connecting suburban areas



Distance to train station
 Below 2.3 km
 2.3-4.7 km
 Above 4.7 km

Metra stop
 Metra line

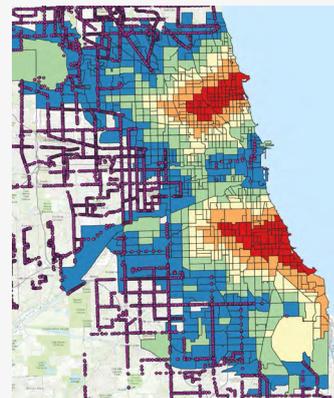
CTA connecting mainly North & partially South Chicago



Distance to CTA station (km)
 0-0.27
 0.27-0.71
 0.71-1.69
 0.69-2.97
 2.97-4.75

CTA line
 CTA stop

PACE connecting the outskirts vertically



Distance to PACE station (km)
 0-1.1
 1.1-2.4
 2.4-3.9
 3.9-5.3
 5.3-8

PACE stop

Different incentives depend on providers

- ✓ Political incentives
- ✓ Structural incentives

RTA together with the mayor's office embodying equity-focused political incentives

Metra, CTA and PACE operators having incentives to improve their ridership and on short-term planning of new routes to reduce possible losses

Note: ¹Regional Transportation Authority

Sources: Expert interviews; BCG analysis



Most severe pain points: Mobility deserts and long commuting times

Observing movement patterns in Chicago, a few pain points clearly emerge:

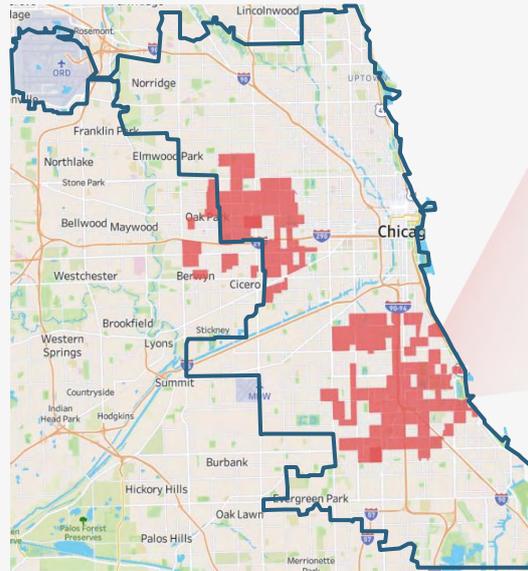
- Low-income households spend up to 35% of their income on transportation. This figure is skewed higher by the cost of vehicle ownership. As many as 74% of low-income households are compelled to have cars because of the prevalence of mobility deserts outside the city centre.
- Average work commute time on public transit for individuals who live in low-income areas is about 57 minutes compared to an average of 44 minutes for residents in the high-income Lake View area (Figure 7). Moreover, people in

low-income households must make multiple transfers during their commutes. In short, the only real alternative to cars available to these households is neither viable nor sustainable, and certainly not helpful in lifting these Chicago residents to the next socio-economic strata.

- The high concentration of jobs and higher wages in the city centre, combined with this patchwork mobility system, exacerbates economic inequity in the city. Some limited but real movement, however, among urban, transportation and economic development planners has occurred to make more jobs in the city centre accessible to a more heterogeneous group of workers.

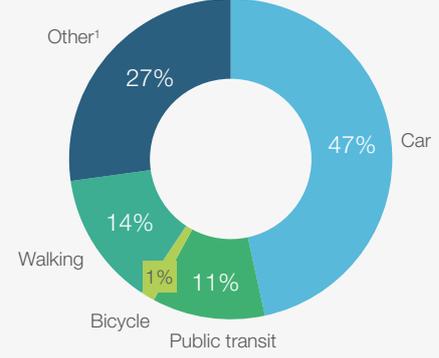
FIGURE 7 Clear separation between high- and low-income neighbourhoods for commuting

Low-income communities are localized in south & west

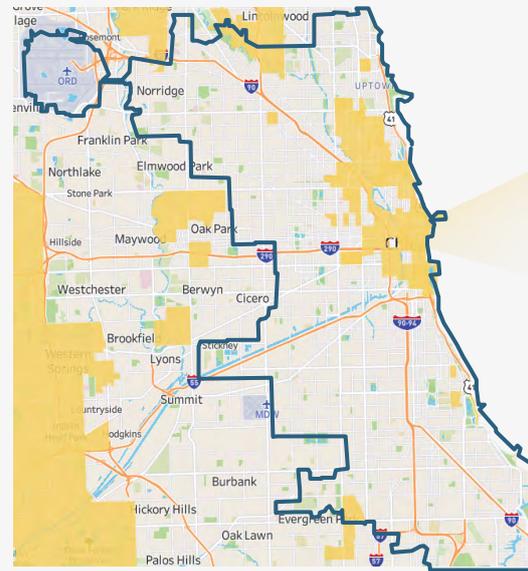


- Low-income areas with 29% of all low-income people living
- ✓ N/S Lawndale
- ✓ Humboldt Park
- ✓ E/W Garfield Park
- ✓ Oat Park
- ✓ West Englewood
- ✓ Chicago Lawn
- ✓ Back of the Yards
- ✓ Greater Grand Crossing

- ✓ Average yearly income: \$27,000
- ✓ Average travel time to work in central business district by public transit: 57 min.
- ✓ Average mode changes: 2+

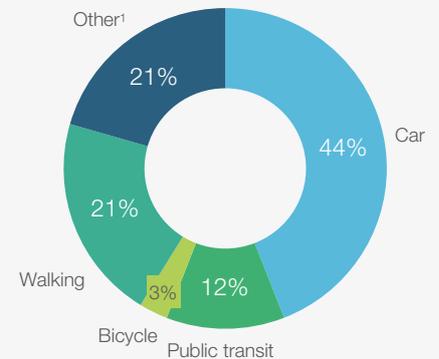


High-income communities live mainly on the lake side



- High-income areas with high concentration of high-income communities
- ✓ S Loop
- ✓ Lake View
- ✓ Lincoln Park
- ✓ Wrigleyville
- ✓ Uptown

- ✓ Average yearly income: \$137,000
- ✓ Average travel time to work in central business district by public transit: 44 min.
- ✓ Average mode changes: 1



Note: ¹Passenger in car, carpool, school bus, private shuttle bus, taxi; numbers reflect all trips for the mentioned population segment

Source: World Economic Forum, University of St Gallen and BCG analysis

The city has also implemented a few transportation initiatives in recent years to tackle some of these pain points:

- Fare Transit South Cook instituted a 50% fare reduction on Metra southern lines and increased the frequency of trains going to and from that area in non-rush hours to accommodate late-night shift commuters. The willingness to use a Metra train instead of a car, however, was not as strong as expected, as many people living in low-income neighbourhoods lack easy access to public transit.
- Elevated Chicago focuses on improving the amenities and attractiveness of the areas around transit stations. These efforts are meant to increase the appeal of public transportation and to directly address improving demand.
- An initiative called Bus Rapid Transit introduced express bus lanes to reduce commuting time. The project sparked some backlash from car-centric communities that felt this project would add to vehicle traffic congestion, and some businesses complained that reduced bus stops will limit their walk-in customers.

- The service areas of a few alternate modes, such as shared bicycles, were extended into low-income communities at discounted rates. These expansions are intended to measure whether residents in these communities would be willing to try out new types of transportation – so far, the results have been encouraging.

Three potential solutions that could best affect the economic development of underserved populations in Chicago were identified:

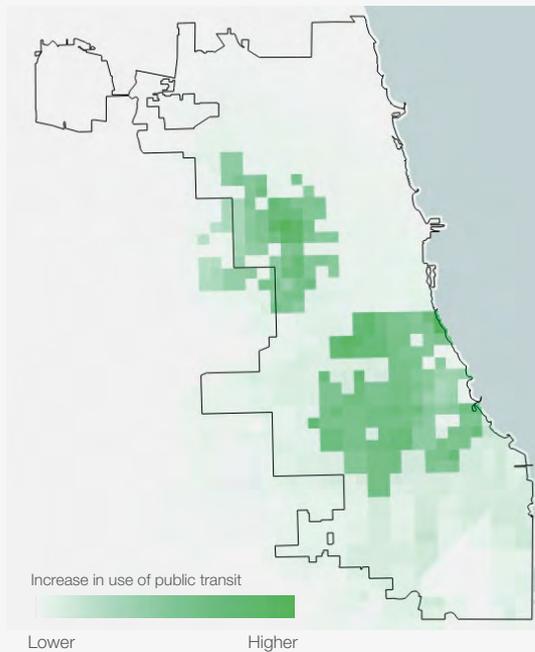
- **On-demand shuttles in underserved areas** could better connect low-income residents with the main public rail system (Figure 8). These shuttles would allow people to pre-book rides to and from local public transit stations, with arrival and departure times coordinated with train schedules. This solution would increase the share of public transit usage in Chicago by 26% and would broaden the number of jobs reachable in 40 minutes – the rough ceiling for a desirable commuting time – by 90%.

Tested solutions:
On-demand shuttles,
priority bus lanes
and congestion
pricing

FIGURE 8 On-demand shuttles in underserved areas for first/last mile

On-demand shuttles in underserved areas for first/last mile

This lever has significant impact on transit usage and nearly doubles job accessibility



KPIs



Share of trips made by selected modes

Addressed segments



South/West

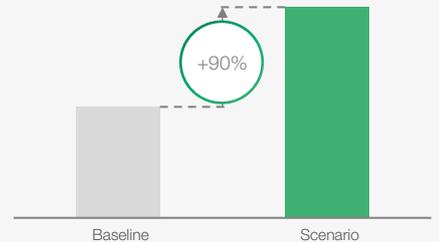
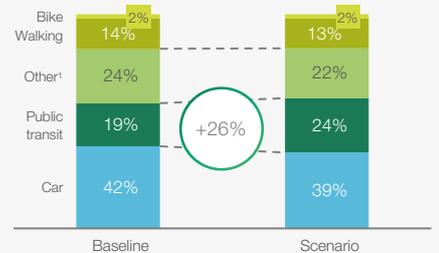


Number of jobs accessible²



South/West

Effects on segments



Note: ¹Passenger in car, carpool, school bus, private shuttle bus, taxi; ²In 40 minutes by public transport, including competition-adjusted jobs

Source: World Economic Forum, University of St Gallen and BCG analysis

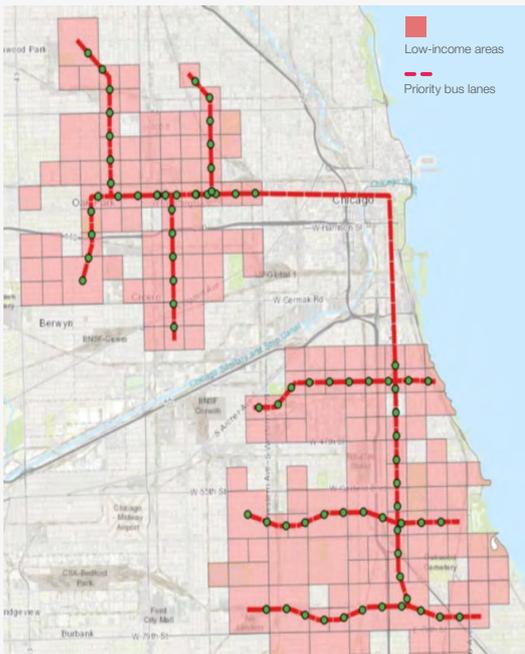
- **Priority, express bus lanes in peak hours running from underserved areas to areas with high job density** could help decrease commuting times, the single greatest indicator of someone’s ability to escape poverty. But similar to the rapid bus lanes, a simulation of this solution showed that it did not have a meaningful impact on increasing public transit

ridership. One explanation for this might be that for many people living in those areas, the nearest public transit station is still too far away to become an attractive alternative to the private car. It could, however, reduce overall travel time to work by 11% and improve job accessibility by 39% for current users (Figure 9).

FIGURE 9 Priority bus lanes from underserved areas to job areas

Add priority bus lanes from underserved areas to job areas¹

Priority bus lanes show a decrease in overall travel time by 11% and a higher accessibility to jobs



KPIs



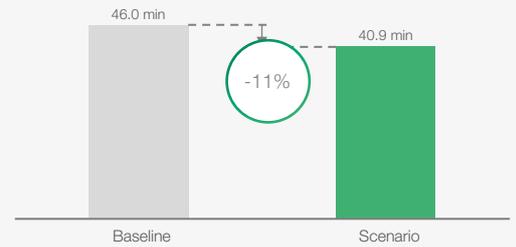
Average travel time to work²

Addressed segments



South/West

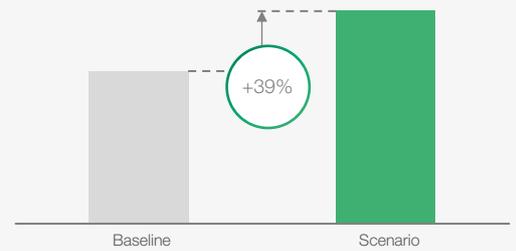
Effects on segments



Number of jobs accessible³



South/West



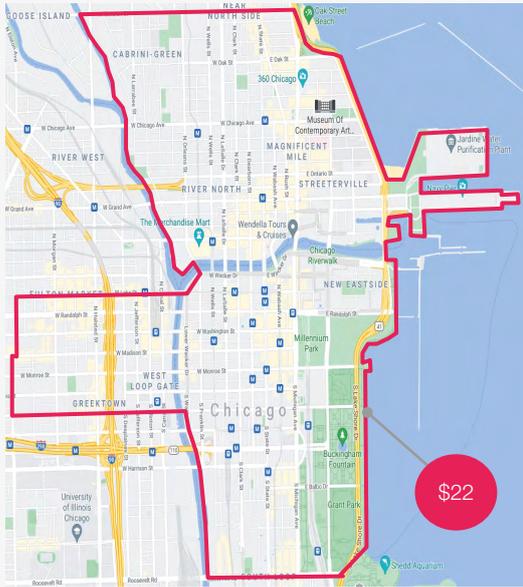
Note: ¹The suggested bus lanes only consider the central business district that hosts 50% of medium-salary jobs; ²Measured for those jobs exclusively located in the central business district; ³In 40 minutes by public transport, including by priority bus lanes

Source: World Economic Forum, University of St Gallen and BCG analysis

- **Congestion pricing** could reduce the number of cars in the city centre, making other modes more appealing. To have a meaningful effect, a \$22 maximum fare, cut in half for car poolers (in line with London’s congestion pricing and adjusted for average household income), would have to be imposed on vehicles traveling to the city centre and back. That would increase the share of public transit usage by 20%

and decrease the share of car usage by 8%, cutting carbon emissions by 5% with virtually no effect on average cost of travel (Figure 10). Congestion pricing must be introduced carefully, however, as it can hurt car-dependent, low-income communities disproportionately. It should be combined with other solutions that provide less wealthy neighbourhoods with a viable and attractive alternative to cars.

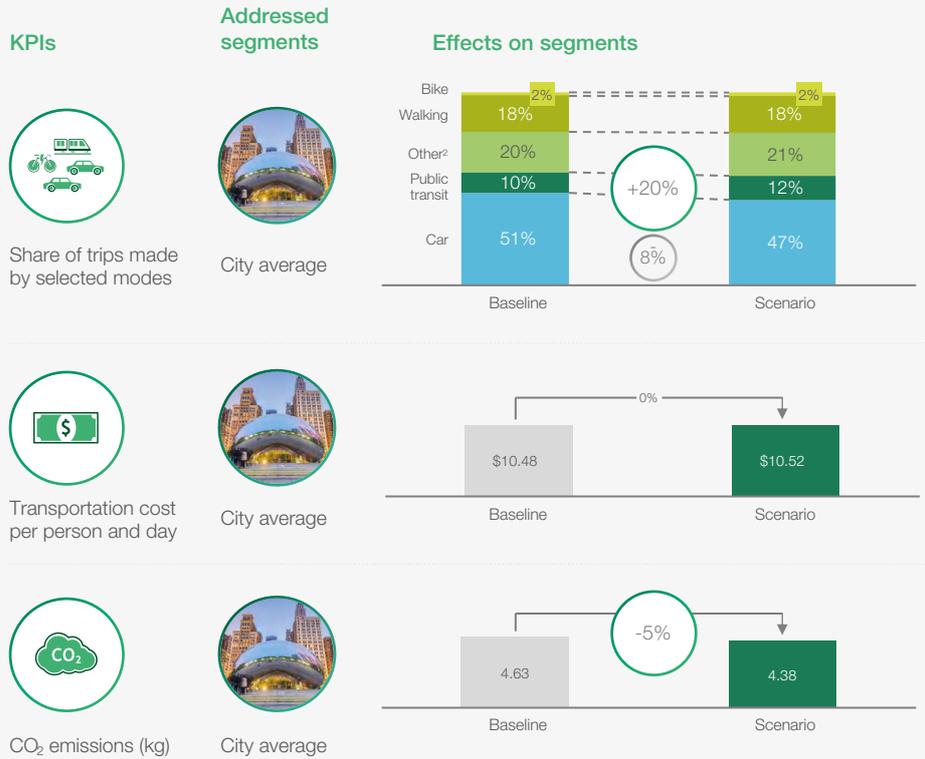
Introduce congestion pricing in central business district¹



Note: ¹Western boundary is Lake & Jackson to Racine and Northern boundary, and South is the Loop Division; ²Passenger in car, carpool, school bus, private shuttle bus, taxi; shares shown only for home-based and return trips; Congestion charge consistent with London (£15), adjusted for average household income

Source: World Economic Forum, University of St Gallen and BCG analysis

Significant effect on car usage and carbon emissions with only marginal effect on cost



i Defining an on-demand shuttle pilot for West Englewood

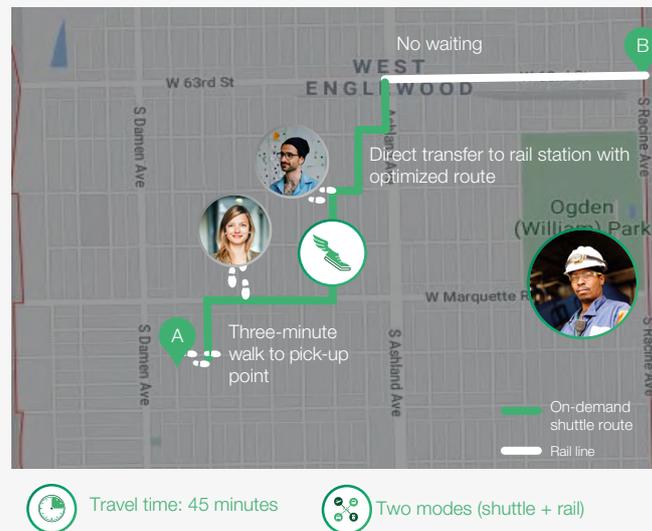
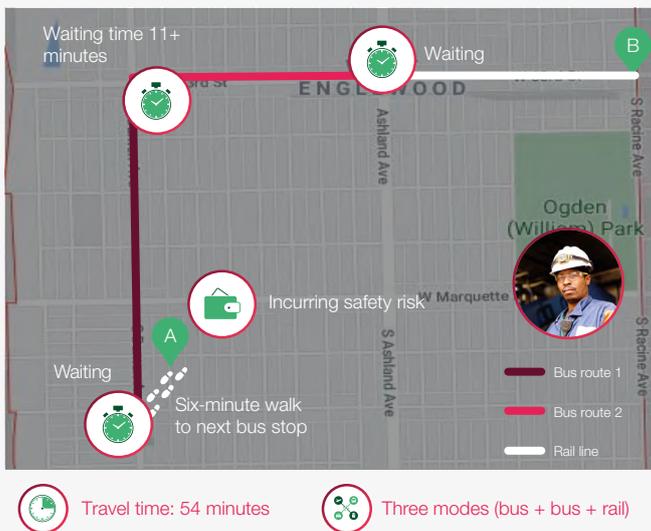
Based on this analysis, on-demand shuttles in underserved areas could significantly address one of the biggest inclusivity pain points in Chicago: the separation of low-income communities in the southern and western parts of the city from the city centre. As this solution could be tested and implemented fairly quickly, it was selected for deeper exploration.

A possible section to implement the pilot could be West Englewood, an area of about 8.2 km² and home to about 32,000 people, 15% of whom commute to the central business district by public transport. The average household income in the community is \$27,000, ranking it among the poorest neighbourhoods in Chicago. The addition of on-demand shuttles to and from the West Englewood Ashland/63rd Metra rail station would eliminate long walks or transportation mode changes between the terminus and people's homes, as shown in our model customer journey (Figure 11).

If these shuttles ran during peak hours (06.00-10.00 and 17.00-21.00), most commuters could profit from this service. Women and early-morning or late-night shift users would benefit from a safe ride since they would be picked up or dropped off no farther than 200 metres from where they live. Also, by coordinating shuttle arrival at the station with rail schedules, commuter waiting times for trains would be considerably lower than it currently is. In the pilot stage, pre-booking would be essential for route planning but as the system scales up and learns the travel patterns in multiple communities, a more flexible on-demand programme could be implemented.

John waits three times (for bus and train) and needs to walk twice when commuting to work, risking assaults.

With an on-demand shuttle, John only needs to reach the point of collection to be driven directly to the rail station.



Note: Indicative travel time at peak hour on weekdays (08.00-10.00) from 6810 South Winchester Avenue to Ashland/63rd station; suggested route by public transit (left) and shuttle (right)

Sources: Google Maps; Chicago Transit Authority; World Economic Forum, University of St Gallen and BCG analysis

Several cities have implemented similar services, although not always with the intent to improve social inclusion by improving commuting services in underserved areas:

- Los Angeles implemented Metro Micro, a three-year pilot for ride pooling that covers eight peripheral rural zones with an introductory price of \$1/ride and a promise of pickup within 15 minutes. Programme advantages include its affordable fare, its focus on the outskirts of the city and the option to pay with a MetroCard.
- Berlin has implemented the ride pooling service Berlkönig, which covers the centre and eastern side of the city for a flexible fare that averages €5 and pickup within 10 minutes. The programme’s strong marketing campaign, responsive service and wheelchair accommodation have helped make it popular.
- In Paris, PLUS by Via offers shared electric vehicles that cover the city centre for €5. These cars are available 24/7 and are environmentally friendly.

This proposed solution for Chicago has a high probability of substantially affecting poorer communities because it is customized to address pain points in a geographically limited area. Based on this analysis, this project could reduce travel time to a job in the central business district by 16%.

Examining how to fund such a shuttle service, Los Angeles invested \$29 million in Metro Micro to acquire 100 vehicles for eight areas. A Chicago pilot with 20 to 30 vehicles could be implemented for an estimated \$7 million-\$8 million. Funds could be drawn from revenue generated by:

- Congestion pricing
- Differentiated service levels on public transport
- Company sponsorships with long-term contracts for ongoing financing
- Advertising in public transit systems

City supporters of the shuttle project would need to make a business case for the project as a first step, validating assumptions (including runtime, potential expansion plan, KPIs and baselines) and initiating strategic planning. Further, proponents would need to select partners to provide the service and to jointly decide with them how to overcome any barriers while further fine-tuning the pilot concept.

Of course, the communities targeted by the initiative would have to be involved in polishing the idea and ensuring that implementation adequately addresses their pain points. By establishing such a programme thoughtfully, the city could take a position of leadership in demonstrating the correlation between access to transportation and socio-economic gains.

📍 Paving a path forward: Optimize existing infrastructure and add new modes

Car-centric large cities, such as Chicago, generally lack sufficient public transit offerings to address the needs of all their constituents, typically leaving underserved communities behind. Focusing economic activity in single city centres only compounds this mobility problem. A dire need exists for these cities to increase the supply and

quality of mobility solutions, primarily by advancing the existing public transit infrastructure and with complementary modes that connect lower-wage populations to the existing public transit system. It is crucial, however, to tie the investment in supply to the characteristics of local demand.



1.2 The compact middleweight: Berlin, Germany

Intertwined,
heterogeneous
City

Berlin is polycentric city with a Kiez structure (one that consists of multiple, commercially active and culturally diverse neighbourhoods), reflecting a high degree of social heterogeneity. Winding through these many communities, public transit in Berlin is widely available. In fact, Berlin often scores at the top of urban transit system rankings. Berlin's strong system reflects the elimination of the historical East-West divide and the evolution of differences between the city centre and peripheral areas (Figure 12).

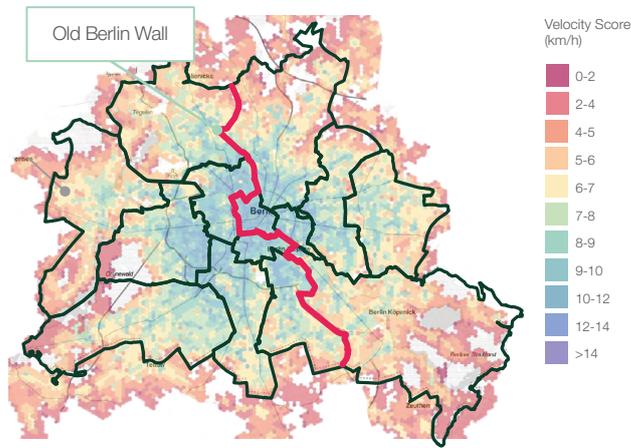
Consequently, compared to Chicago, fewer trips are made by car (22% of all trips, or one-third of Chicago's share). In addition, the combination of an accessible public transit system and relatively high job availability throughout the city results in the shortest average commuting time of the three cities examined (Berlin: 44 minutes vs Beijing: 56 minutes vs Chicago: 59 minutes).

Although Berlin is fast growing, some of its districts are among the poorest in Germany. Yet, unlike other cities, the worst public-transit-served areas are those with relatively high socio-economic status. This is an example of the "opting-out" phenomena – namely, by living away from city centres, wealthier Berliners are avoiding city disadvantages (such as noise and pollution) and its advantages (extensive public transportation). Hence, high-income Berliners compensate for less public transit with more use of private cars. Some of Berlin's periphery areas, however, are also home to a large number of low-wage earners who cannot easily overcome the lack of public transportation.

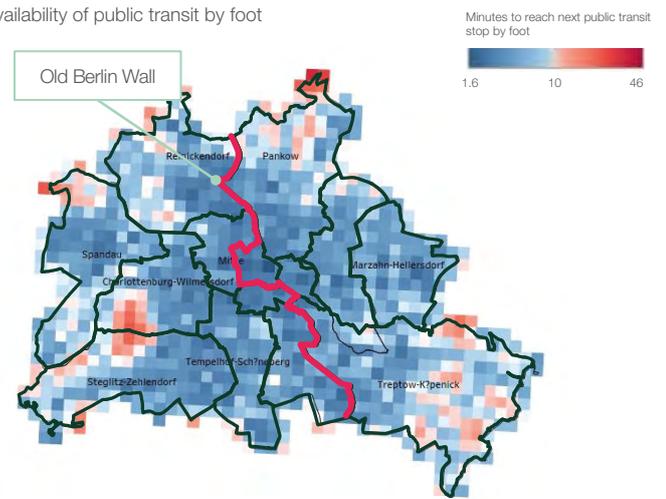
Velocity¹ of access by public transit mainly changes in central vs peripheric areas, with no E/W differences

Similarly, availability of public transit reflects no E/W difference, but between the centre and periphery

Velocity score via public transit in 2020

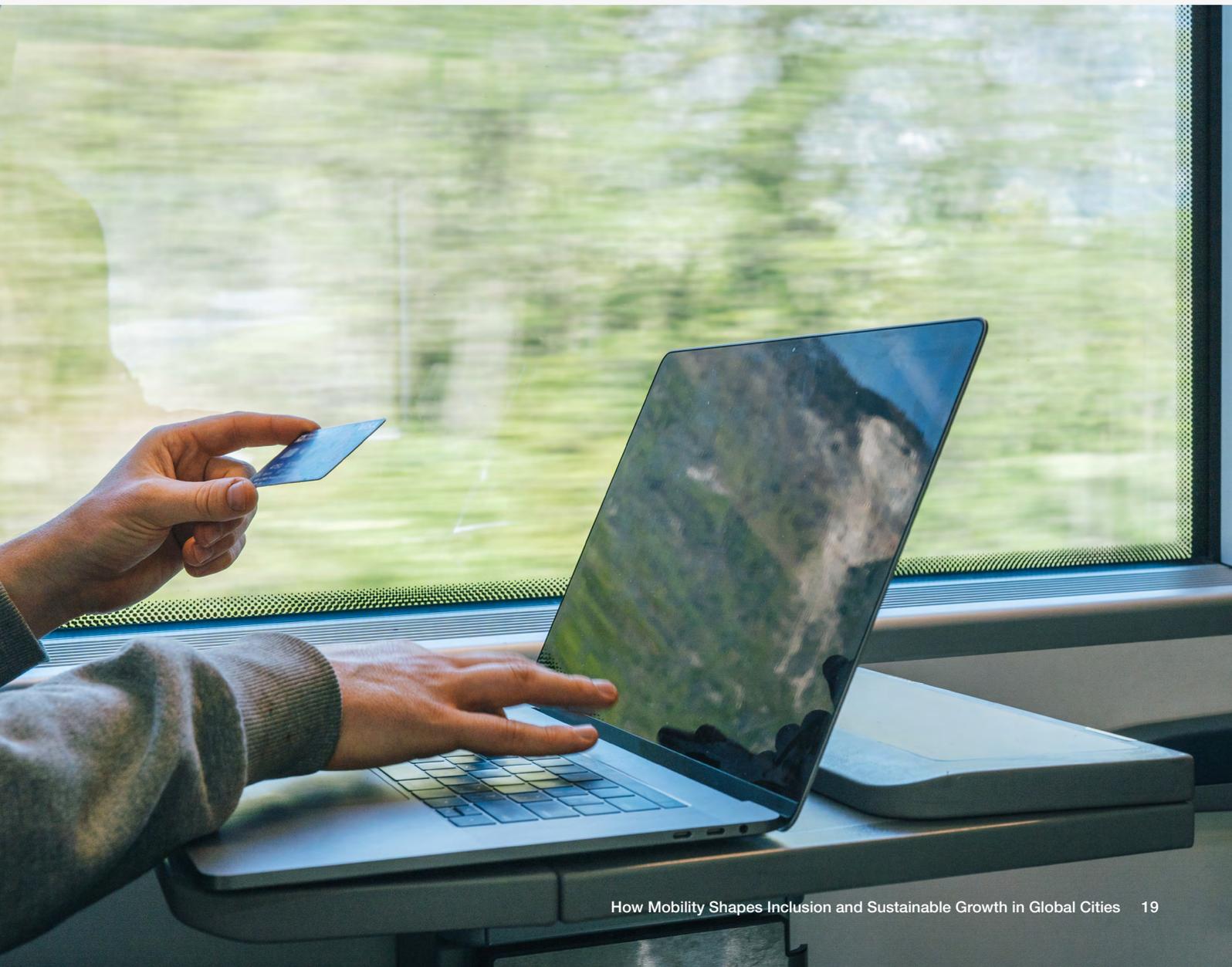


Availability of public transit by foot



Note: ¹The velocity score measures how fast any point can be reached from any other point in the city by walking and public transit

Sources: Biazzo, Indaco, Bernardo Monechi and Vittorio Loreto, “General scores for accessibility and inequality measures in urban areas”, *Royal Society Open Science*, vol. 6, no. 8, 2019; University of St Gallen and BCG analysis



Most severe pain points: Social issues and gentrification in low-income communities

Analysing Berlin's mobility patterns, these pain points stand out:

- While the availability of public transportation in less well-off neighbourhoods is generally not an issue, the lack of accessibility of new modes of mobility and rapidly advancing digitization threaten to leave these communities further behind economically. Recent mobility breakthroughs, such as on-demand shuttles, micro-mobility offerings (e.g. bikes, scooters) and car sharing apps, could be better integrated at affordable prices.
- The digitization of these new mobility solutions disenfranchises Berlin's less educated communities, where digital illiteracy can make transportation more difficult to navigate. In addition, while physical disabilities are consistently considered today in designing transportation systems, intellectual disabilities are not always taken into account.

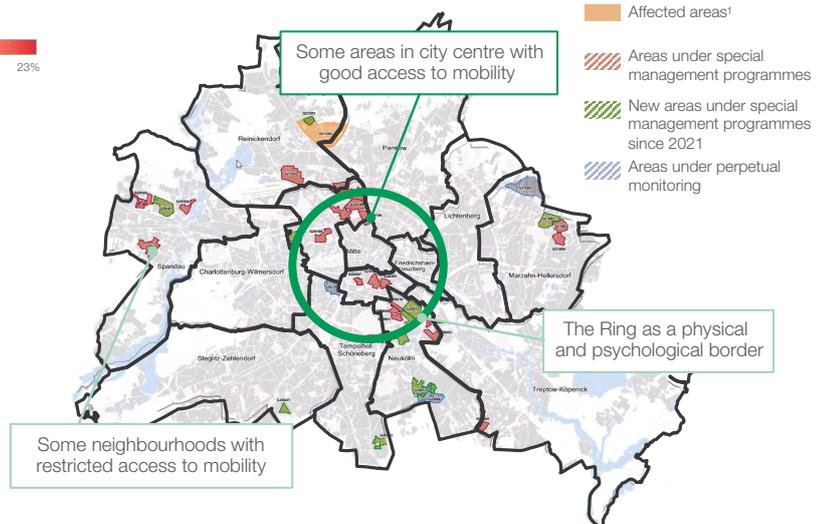
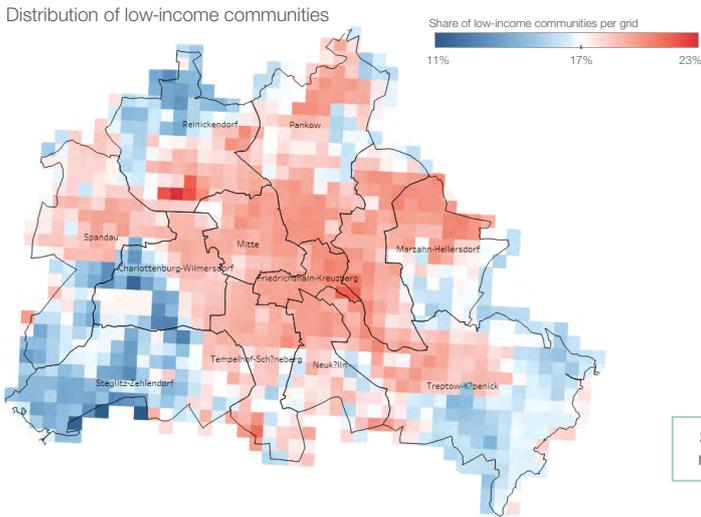
- Central districts are undergoing gentrification, pushing poorer populations to the outskirts, which will magnify their transport challenges. Berliners living in peripheral areas need approximately 27% longer for commuting than central Berliners despite the good public transportation systems. As these outer, less wealthy neighbourhoods emerge, providers of new mobility are hesitant to enter the market due to challenges in establishing a profitable business model.

Like Chicago, Berlin has recently implemented transportation programmes, and plans more, to at least address some of the disability and affordability concerns (Figure 13).

FIGURE 13 Improved mobility and social programmes in some poorer areas

Low-income communities widely distributed within districts

Most affected areas to be improved by social programmes



Note: ¹Area defined by the city council in urgent need of development as its inhabitants are currently socially and economically disadvantaged (§ 171e BauGB)

Sources: Expert interviews; Senate Department for Urban Development and Housing, Berlin Department, 21 September 2021, <https://www.stadtentwicklung.berlin.de/>

The implemented programmes include the following:

- The Berlin Mobility Act is expanding new forms of mobility, such as bicycles and car sharing, in communities across the city.
- The Berlin Pass, providing lower or free fares for less wealthy public transport riders, seeks to increase demand and intracity travel.
- Ten-minute schedules for public transit frequency are slowly being rolled out in the city, which could improve the use of public transit by a wider group of people.
- Free personal support could help the elderly and people with disabilities use public transit for doctor's visits or shopping trips, among other important destinations.

Tested solutions:
Differentiated service levels on public transit, on-demand shuttles and congestion pricing

Because Berlin has an advanced and available public transport system that would be difficult to improve with traditional measures, the applicability of a variety of other, more creative approaches for tackling pain points was tested:

- **Differentiated service levels on public transit**, with premium class tickets priced at 3.5 times current fares and general fares reduced by 20%, would be similar to offers from airlines or intercity trains. To justify the higher price, the premium class would need to address the needs of the potential users, e.g. by providing more space and privacy with higher comfort seating, WiFi, digital pre-booking functionality

and similar amenities. Based on the simulation, the share of public transit usage in Berlin, especially among high-income commuters, would increase by about 11%, and the share of car usage in the city would drop by about 4% (Figure 14). This would benefit decarbonization, and while per-person transportation costs would be unchanged, transit revenues would rise by 28%. Although considering that such a premium public transit class offer would require significant investments to justify the higher price, the additional source of money could subsidize transportation-based social inclusivity initiatives in less well-off areas of the city and improve accessibility over the longer term.

FIGURE 14 Differentiated service levels (“business class transit”)

The lever increases transit revenues by 28% to finance other projects and achieves noticeable impact on KPIs

The solution

Introduce new premium public transit class with more privacy and higher seating comfort to attract a higher share of car travelers

Set higher prices for premium class offering

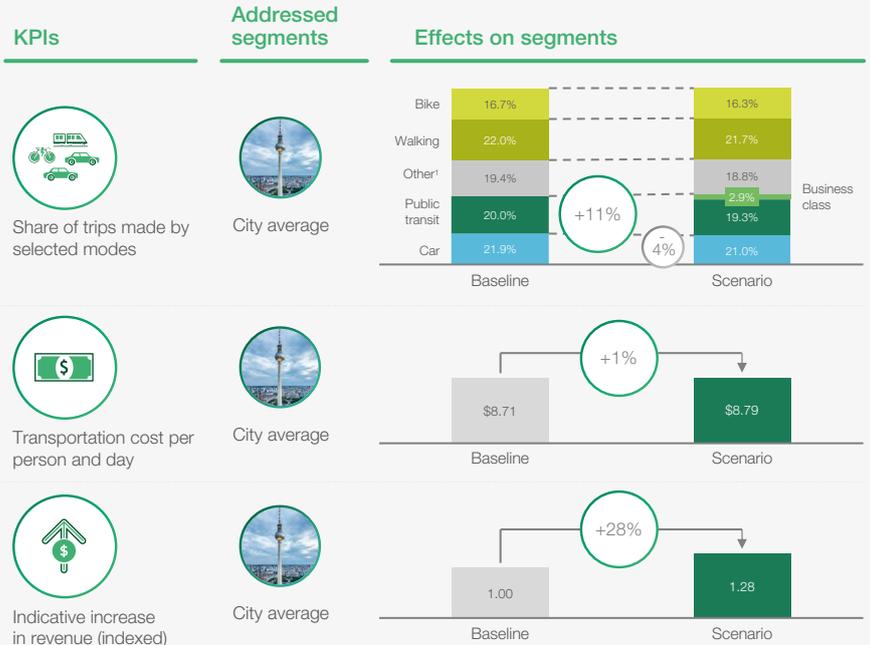
Reduce average price for standard public transit service or extend standard service to outer city areas (cross-financing)

How could the solution be implemented?



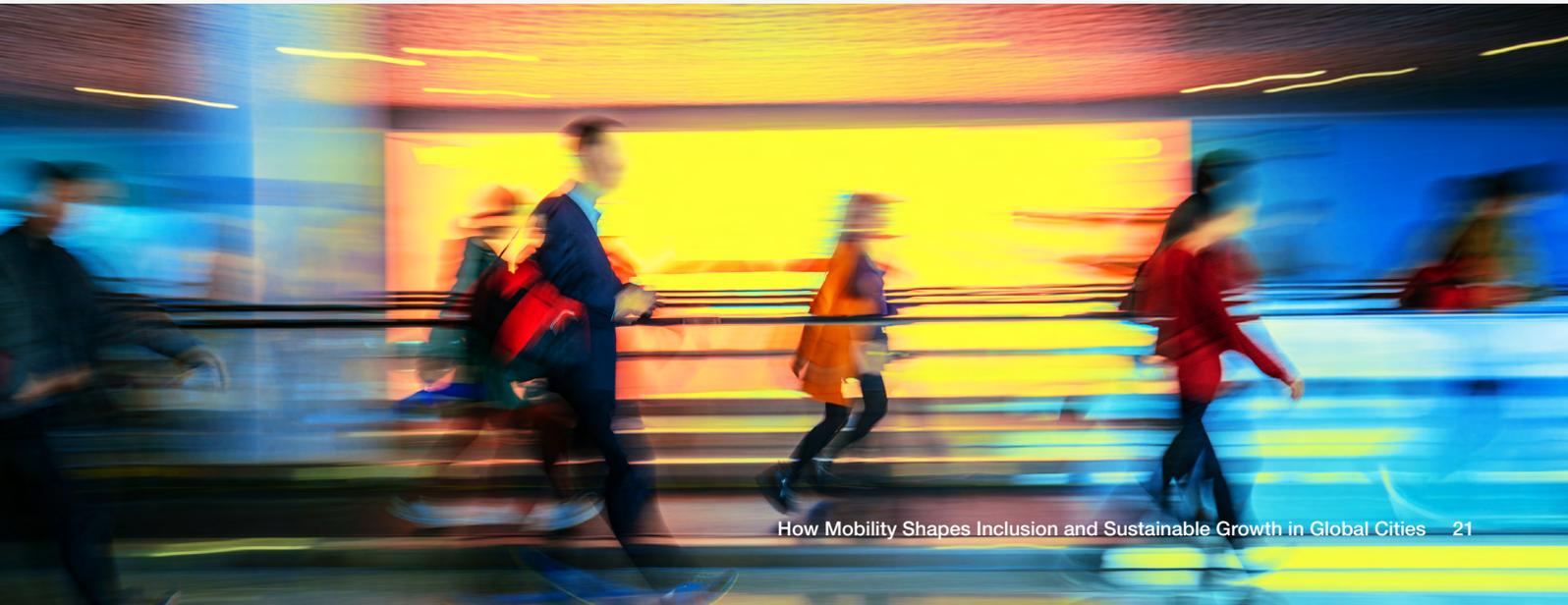
What implications does the solution have?

- Attract high-income communities to use more public transit
- Reduce transportation cost for low-income communities
- Create alternative revenue streams for public transit providers
- Substantially reduce private-vehicle usage to lower emissions & congestion



Note: ¹Passenger in car, carpool, school bus, private shuttle bus, taxi

Source: World Economic Forum, University of St Gallen and BCG analysis



- **New modes of mobility extended to peripheral areas**, such as on-demand shuttles to public transit stations – similar to those described in the Chicago section – could increase the share

of public transit usage by 5% and reduce the share of car usage by 3%. In turn, this would drive up the number of jobs accessible in remote communities by 37% (Figure 15).

FIGURE 15 On-demand shuttles in underserved areas

While modal shares are affected moderately, job accessibility is improved significantly

Pre-bookable shuttles driving passengers from/to public transit stations



KPIs



Share of trips made by selected modes

Addressed segments



Most remote areas (50%)¹



Number of jobs accessible³

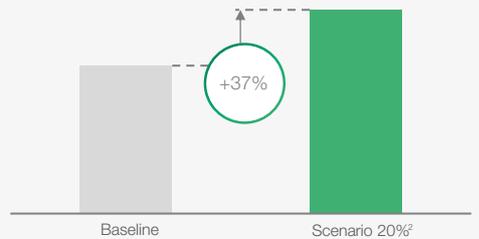


Most remote areas (50%)¹

Effects on segments

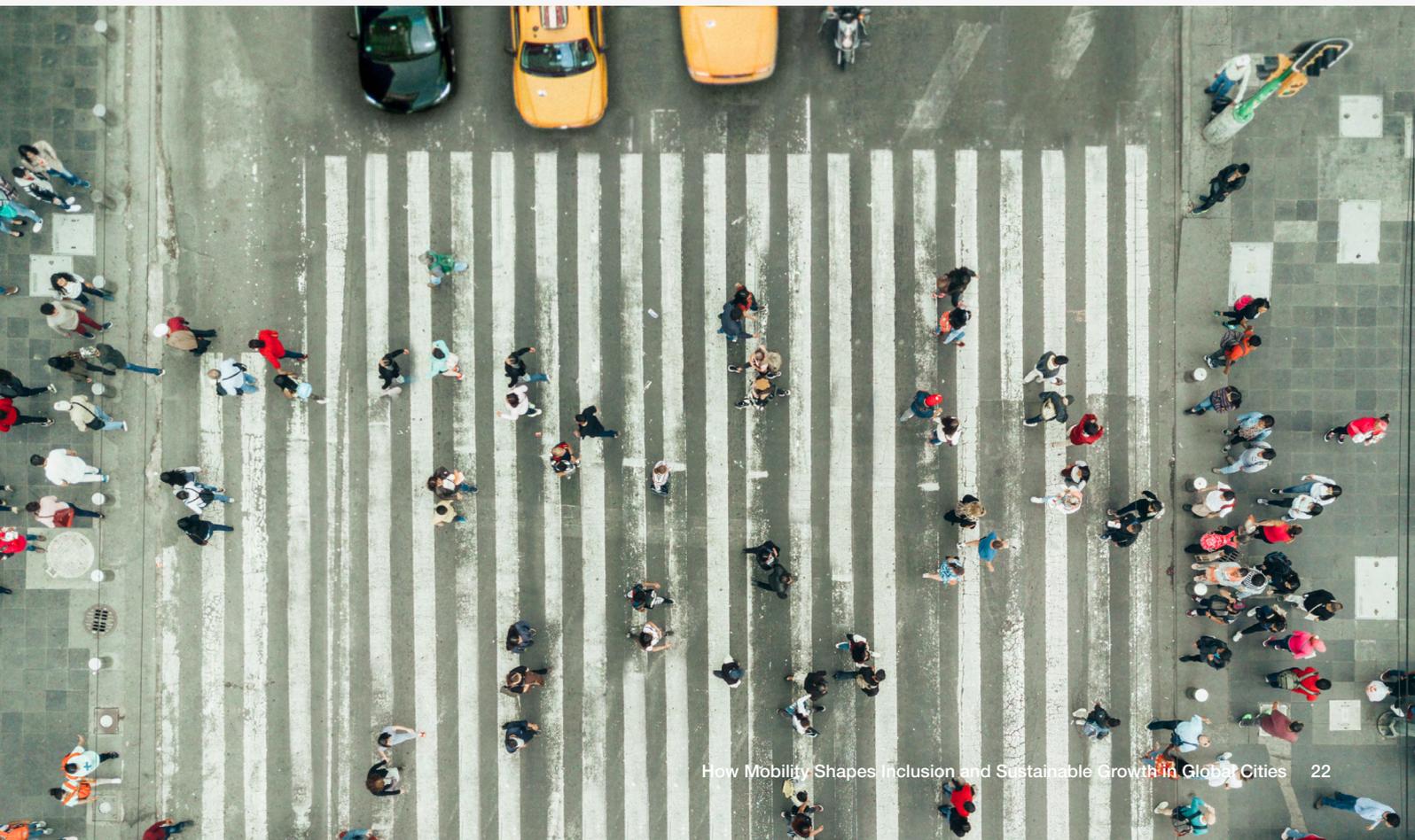
Mode	Baseline	Scenario 20% ²
Bike	15.7%	15.5%
Walking	19.2%	19.2%
Other ¹	17.0%	16.8%
Public transit	23.8%	25.0%
Car	24.3%	23.5%

Public transit with on-demand shuttles



Note: ¹Passenger in car, carpool, school bus, private shuttle bus, taxi; ²Of 50% of the most remote areas in Berlin, take 20% of areas with the poorest public transit accessibility; ³In 40 minutes by public transport, including competition-adjusted jobs; ⁴Shares shown only for home-based and return trips; k = thousand

Sources: ioki; World Economic Forum, University of St Gallen and BCG analysis



- **Congestion pricing** proved to be a double-edged sword. Two scenarios were simulated: introducing a €12 fee for entering the city centre vs entering the entire Ringbahn area (Figure 16). On the city average, transportation costs increased by 5% (city centre) and 13% (Ringbahn area), but at the same time, it helped to reduce the share of car trips and thus also showed a positive impact on carbon emission

levels (-2% vs -7%). Combining congestion pricing with other measures described above, such as introducing differentiated service levels on public transit or providing on-demand shuttles in peripheral areas of Berlin (both increase the attractiveness of public transit), should be considered to lower the negative impact on transportation cost.

FIGURE 16 Introduction of congestion pricing

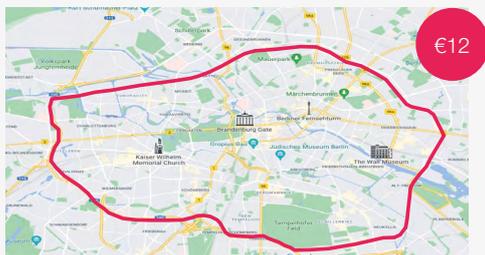
Illustrative 

Scenarios

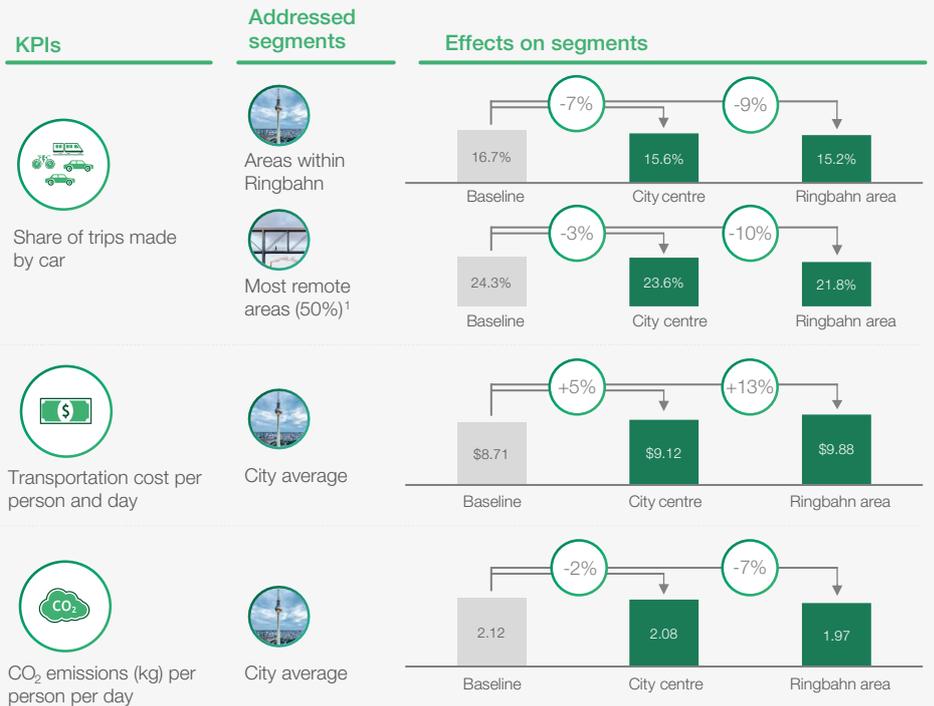
City centres:
Area where parking ticket is required (17 km²)



Ringbahn area:
Entire area defined as "A-zone" by BVG (88 km²)



Only an aggressive approach works in Berlin due to lower car usage and reliance on travel to the centre



Note: ¹Shares shown only for home-based and return trips; Congestion charge consistent with London (£15), adjusted for average household income; BVG: Berliner Verkehrsbetriebe (the main Berlin public transport company)

Source: World Economic Forum, University of St Gallen and BCG analysis

i Paving a path forward: Balance supply and demand solutions

The mobility system in Berlin, a polycentric middleweight city with a series of somewhat self-enclosed neighbourhoods, is more mature than Chicago's and more widely dispersed. Therefore, simply augmenting supply does not yield the same results as in a car-centric city.

The economic challenges in Berlin are difficult to blame on traditional mobility gaps. Instead, the research highlighted an interesting twist on planning mobility systems. Namely, public transit systems and cars, and even other modes like bikes, scooters and shared mobility, should not be viewed as the sole determinants of mobility freedom and patterns of movement in an urban area. A series of less tangible, harder to measure factors that shape a population's mobility behaviour, such as culture,

education, social perception, community structure and language, is essential to consider as well. For example, in Berlin, some immigrant communities restrict their own movement to a single neighbourhood. The polycentric nature of the city means that these communities might still find jobs and education without the need to travel far. Hence, focusing on long distance transportation solutions will not bring the same return on investment as they would in many American cities.

Thus, while an effective mobility network is fundamental to pursuing universal access and participation, such a system must be complemented by other inclusion measures, such as urban development, education and cultural offerings. Inclusive mobility is only valuable to

underserved communities when it provides access to truly supportive assets and when individuals realize and utilize the potential of these assets. Moreover, social inclusivity supported by transportation initiatives goes well beyond simply improving economic conditions; it also includes, for instance, better service levels for the blind or people with mental disabilities, or people who are new to the culture. In other words, inclusive mobility systems must not only be judged by the supply of transport infrastructure, but also by whether the demand side perceives the value of this infrastructure and whether people's lives are improved sufficiently by it that they are motivated to take full advantage of it.

Being polycentric is a great asset for Berlin. It produces self-sufficient districts (small cities within the city) in which people can even go by foot or bicycle to essential services. This offers the potential for highly inclusive as well as sustainable mobility systems. However, this quality goes hand in hand with the risk of creating residential areas and sub-cultures that are unequal in quality of life and that are not very permeable. To address this risk, urban and mobility planning should ensure that: 1) social inclusivity is equalized in different areas; and 2) barriers to travel between neighbourhoods, including for people who do not speak local languages, are eliminated.



1.3 The high-density megacity: Beijing, China

Next-level
demand for
mobility
solutions

Beijing's population is 22 million, and the city hosts about 1 million temporary visitors per day. It has a concentrated monocentric structure with six small centres, partially composed of circles or ring roads that start from the city centre and expand in size as they approach the outskirts. About three-quarters of the jobs in Beijing are located within the 5th Ring Road. With that density, people are able to reach on average nearly 2 million jobs in 40 minutes by public transit, the best score across the three cities in this analysis.

Beijing's mobility system is extraordinarily active: 13.2 billion trips annually (public transit and private vehicles) within the metro area, with 56% as work-related commutes during rush hours. Such high demand has largely overwhelmed the city's public transit network. For instance, queuing times just to get into some train stations consistently top 20 minutes, which has led many residents to choose driving as an alternative. Car ownership in Beijing exceeds that of many other global megacities (0.3 vehicles per capita vs only 0.14 in Tokyo).

Most severe pain points:
Oversaturated public transport and extreme road congestion

Tested solutions:
Digital reservations platforms, mobility as a service, and railway expansion

Beijing's worst mobility pain points can primarily be consigned to three categories:

- Long public transportation commute times: For 68% of riders, a one-way trip takes more than 45 minutes, although Beijing's average commute distance (11.1 km) is short compared to two other global megacities (Tokyo, 20 km; New York City, 18.1 km). Beijing's protracted commutes are driven in part by lengthy distances between transit modes and extended rush-hour queuing times.
- Severe congestion on the roads: With elevated car ownership, Beijing can be a nightmare at rush hour. Ultimately, that affects public transit as well. Navigating Beijing's busy streets, buses arrive on schedule only about 57% of the time. Part of the problem is that driving costs are low³ compared to other transportation modes because Beijing imposes few extra charges common in other cities, such as vehicle plate purchase fees or congestion fees, and parking is inexpensive. And while car ownership is increasing, the growth of the road network length per year is flat.

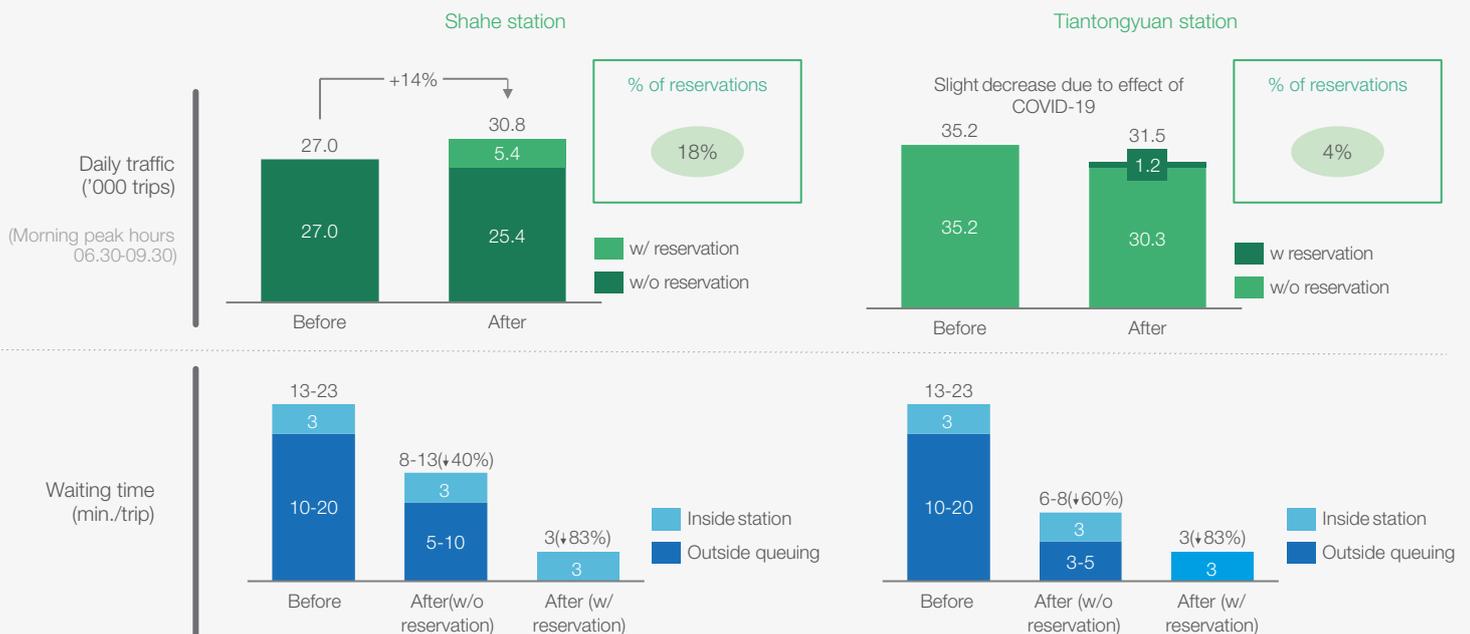
- The need to make progress in reducing pollution and carbon emissions: This is mostly the result of extreme road congestion and time-consuming commutes.

Three solutions were chosen as possible paths for addressing Beijing's mobility pain points:

- **A digital platform for metro reservations** was implemented to flatten peak-hour demand and reduce commute time for rush hours. Since March 2020, three metro stations (Shahe, Tiantongyuan and Caofang) have installed pilot programmes through which riders can reserve a 10-minute time slot for next-day, fast-lane pass access to the train between 06.30 and 09.30.

By converting 20% of total ridership to the reservation system, Beijing could reduce the waiting time for commuters with reservations to get into the station by about 80%, and for those without reservations by about 40% (see the results for two stations, Figure 17). By scaling the reservation system to 80 major metro stations, the one-way commute time could be reduced by 29% for the system users in surrounding areas.

FIGURE 17 Effective waiting time reduction shown in sensitivity scenarios



Sources: Beijing Transportation Institute; literature research; BCG analysis

- **A Mobility as a Service (MaaS) decarbonization programme seeks to reduce road congestion** by encouraging people to switch from private vehicles to greener trip modes, including walking, bicycles and public transportation. Beijing has already developed a pilot MaaS platform, which leverages the

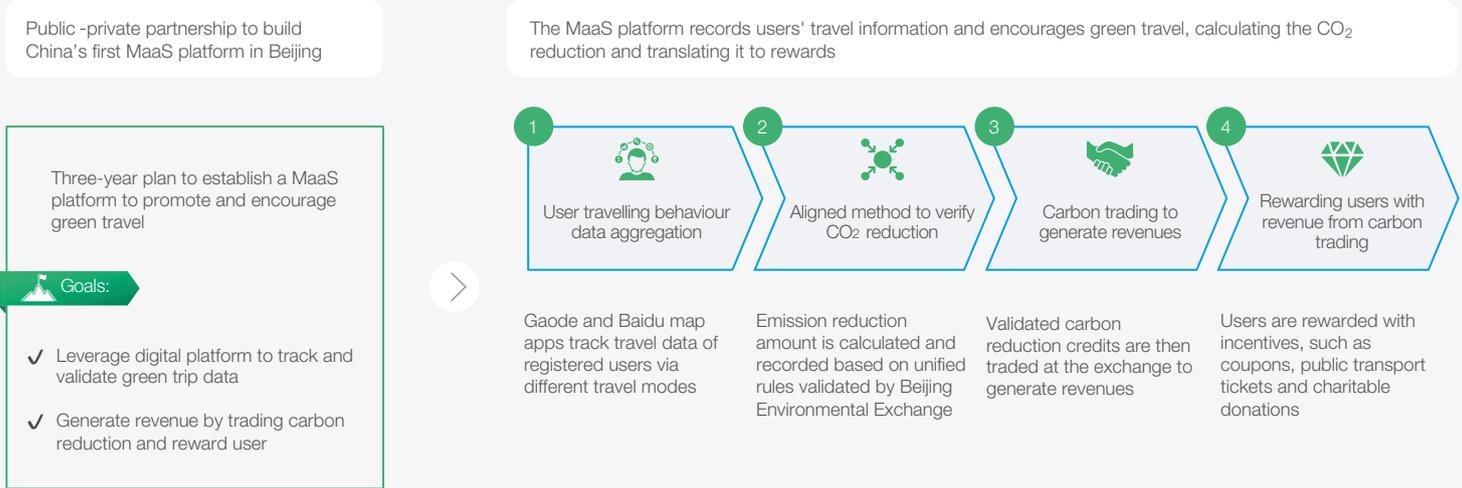
digital capabilities provided by widely used navigation apps and recommends green trip plans based on real-time traffic information. When people choose a green option, carbon emission reduction credits are calculated and users are rewarded with green points, which can be redeemed for coupons, gifts or charity

donations (Figure 18). During the initial seven-month pilot, 145,000 users registered for the programme, accounting for about 15 million green trips. The target is 700 million green

trips per year. Converting 30% of Beijing's total population to actively use green trip planning could reduce city-wide transportation carbon emissions by up to 12%.

FIGURE 18 Introduction of green travel MaaS platform to promote sustainable travel

Green travel MaaS platform introduced¹ to promote sustainable travel



Note: ¹The Beijing Municipal Committee of Transport and Beijing Municipal Ecology & Environment Bureau launched the Traveling Green on MaaS campaign in partnership with Amap and Baidu Map

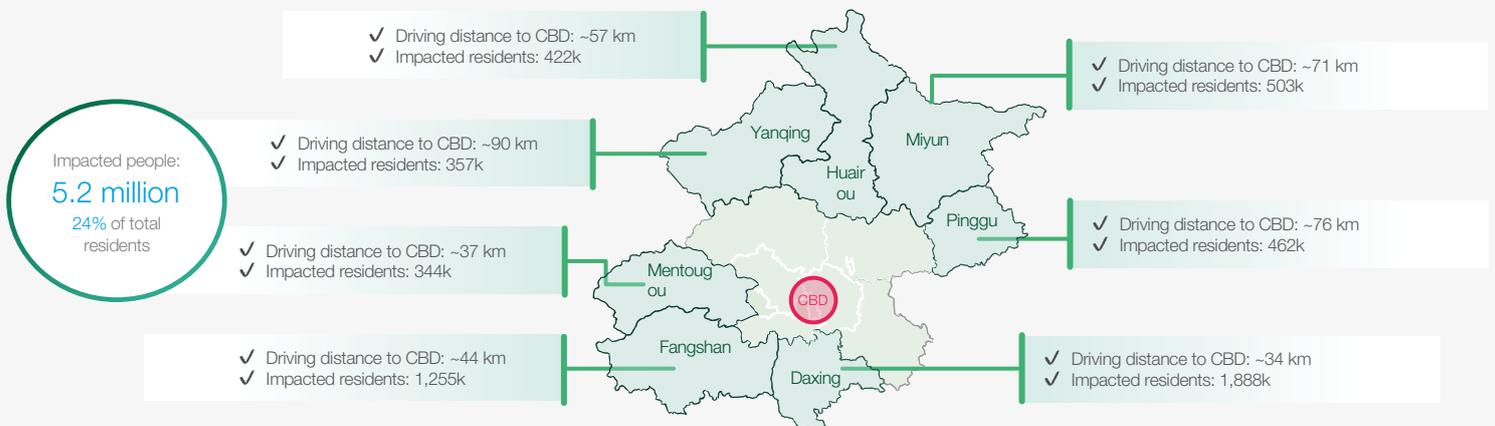
Source: BCG analysis

– **Suburban railways can be expanded to improve commuting to the city centre from seven remote suburban districts**, home to 24% or 5 million of the city's residents.

On top of the demand-optimizing solutions, Beijing should enhance supply where possible, specifically expanding railways in suburban areas (Figure 19).

FIGURE 19 Difficulty accessing the city centre from remote districts

In Beijing, seven remote districts have limited access to public transport



i The suburban railway provides convenient access to jobs in the central business district (CBD) area, improves travel inequality, brings in visitors and enhances economic development in remote areas.

Note: k = thousand

Sources: Expert interviews; literature research; BCG analysis

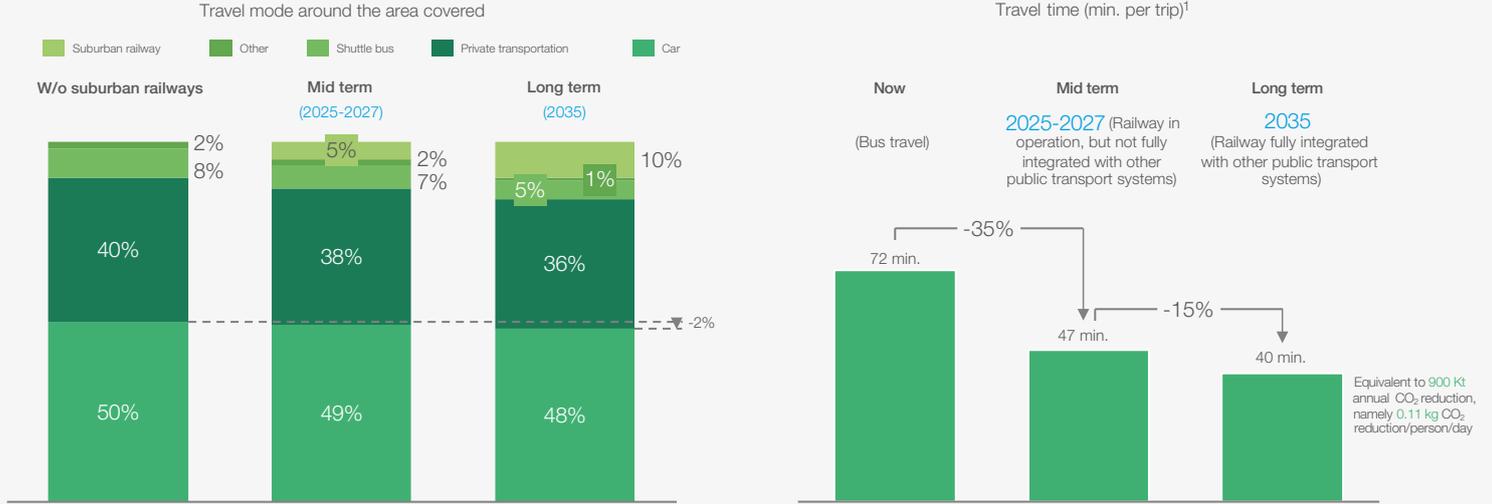
By increasing suburban railways from four to 15 lines (about 10% of the total number of trips between these remote areas and the city centre would be by train) and by linking the new lines with existing metro buses, travel time to jobs could be reduced by up to 45% (Figure 20) and road

congestion would be significantly curtailed as well. In the future, however, the capacity limit of these supply solutions will again be reached. Overall, Beijing needs to concentrate on demand-oriented mobility approaches.

FIGURE 20 Suburban railway to conveniently cover 10% of trips to the city centre

With full operation, the suburban railway will account for 10% of all trips from these areas to the city centre

Travel time will be reduced by 45% each trip with 0.11 kg CO₂ reduction/person/day



Note: ¹Calculated based on a typical commute route in Beijing, from Tongzhou community to Beijing World Towers in the central business district area

Sources: Expert interviews; literature research; BCG analysis





❶ Paving a path forward: Focus on shifting the demand for mobility

By solely addressing long commute times and road congestion, the larger and long-term problems inherent in megacities like Beijing will remain unsolved and will worsen. Instead, cities need to work closely with public transportation system designers to offer people alternative modes of transportation that could attract ridership and take away stress from the existing transportation infrastructure. Among these alternate modes are ride sharing, autonomous shuttles, and bicycle

and e-scooter networks. Moreover, transportation modes must accommodate and grow demand among non-mainstream groups that lack digital literacy, have language issues and disabilities, and are underbanked and unbanked. On a more dramatic level, reshaping centralized megacities into communities of small, independent districts, in which most jobs are within a 15-minute commute time, would have a significant impact on social mobility.

2

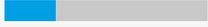
Increasing mobility-driven social equity in archetype cities



While acknowledging that every city has its own mobility ecosystem and social circumstances, for the purposes of this White Paper the three

cities analysed each represents a different urban archetype and distinct stages in the maturity of mobility ecosystems (Figure 21).

FIGURE 21 | **Mobility solution dependent on a city's mobile stage**

	 The car-centric giant	 The compact middleweight	 The high-density megacity
Examples	Chicago	Berlin	Beijing
Description	Unequal infrastructure with spatial inequities	High density of mobility services across the city	Megacity with efficient public transit system
Mobility stage	Optimize supply  Optimize demand	Optimize supply  Optimize demand	Optimize supply  Optimize demand
Key dimensions	<ul style="list-style-type: none"> ✓ Spatial separation between high- and low-income areas ✓ Some disconnected areas with poor public transit access ✓ Need for optimization of new vs existing supply 	<ul style="list-style-type: none"> ✓ Low-income communities spread over entire city ✓ Easily accessible public transit infrastructure across entire city ✓ Need for cross-financing options for new services 	<ul style="list-style-type: none"> ✓ Very high number of commuters on public transit ✓ Highly optimized public transit system ✓ Oversaturated usage of public transport leads back to growing car ownership
Focus on solution	<ul style="list-style-type: none"> ✓ Optimize mobility supply: Grow equitable access to public transport in underserved areas 	<ul style="list-style-type: none"> ✓ Optimize mobility supply & demand: Develop quality of existing levers to meet demand 	<ul style="list-style-type: none"> ✓ Optimize mobility demand: Shift to demand-side-driven solutions

Source: World Economic Forum, University of St Gallen and BCG analysis



2.1 | Car-centric giants: Optimizing supply

The first city archetype to be examined is the car-centric giant. Car-centric giants, often encountered in the United States but also in other parts of the world, typically have a monocentric structure, with a high concentration of jobs, both high- and mid-salary positions, in the city centre. While the population is usually evenly distributed across the large city, transportation infrastructure is not – a structure perfectly observable in Chicago. Car-centric giants usually have some areas of the city (generally the poorer sections) that are utterly disconnected from public transit or are remarkably underserved. As a result, a high percentage of citizens relies on privately owned cars for their commutes, although many of the less wealthy cannot afford private cars.

As socio-economic advances and social inclusion are directly correlated with access to transportation, this city archetype must improve and optimize mobility accessibility in low-income communities and improve infrastructure in mobility deserts. Expanding equitable access to public transit is one idea; connecting underserved areas to existing rail stations, or even introducing micro-mobility solutions (bicycle, e-scooters and mopeds, among other modes) in transportation deserts, are others. All of these solutions could immensely benefit this type of city.

2.2 Compact middleweights: Tackling demand and supply

The second archetype identified is the compact middleweights. These cities are usually polycentric with a high density of jobs and population generally distributed across the urban area. This archetype, Berlin being an excellent example, often has extensive mobility services, including well-functioning public transit systems as well as a significant sprinkling of shared and micro-mobility solutions. As a result, its residents rely less on private vehicles to get around. However, as witnessed in Berlin and observed in other places worldwide, one or more of the many neighbourhoods in the city could organically gentrify. This phenomenon is reflected in low-income communities pushed towards the outskirts, which are clearly underserved by new mobility modes and where public transit, when it exists, is difficult to access.

To increase social inclusivity, city planners should target improvements in demand and supply. This means expanding transport solutions, including shuttles and other short distance vehicles, to the outlying neighbourhoods. It also means making new mobility modes more affordable to low-income communities and to people physically or mentally disadvantaged. Furthermore, new services, expanded in peripheral areas to serve gentrified low-income communities that move to the suburbs, need to be substantially cross-financed to become valid and cheap alternatives to this population segment. On the other side, next to focusing on supply only, demand-augmenting solutions must be attractive enough and improve the quality of life sufficiently so that people are compelled to make good use of them.



2.3 High-density megacities: Optimizing demand

The third archetype examined is high-density megacities, the biggest and most populated of the three archetypes. These megacities have a very large number of residents and a structure that is both polycentric and monocentric, with a large central area where most jobs and the population are concentrated. Beijing was a graspable case, with its six small city centres and its enormous concentration of jobs in the bigger central area. Because of the size of megacities and their multiple centres, and despite widespread public transportation networks, serving tens of millions of people at the same time is virtually impossible to manage at an optimum level. As a result, waiting times to access public transport can be insufferable, especially for the elderly and people with disabilities.

The most successful strategy to tackle the challenges of high-density megacities is to optimize the mobility demand. Solutions like installing digital platforms for people to reserve time slots for fast-track access to public transportation could better spread demand over longer time periods and away from peaks, reducing oversaturation. But even more importantly, other, more ambitious efforts, such as distributing jobs more evenly across megacities to ultimately reduce travel demand (a long-term measure, not a quick win), need to be evaluated and implemented.

2.4 The key to social inclusion: Mobility

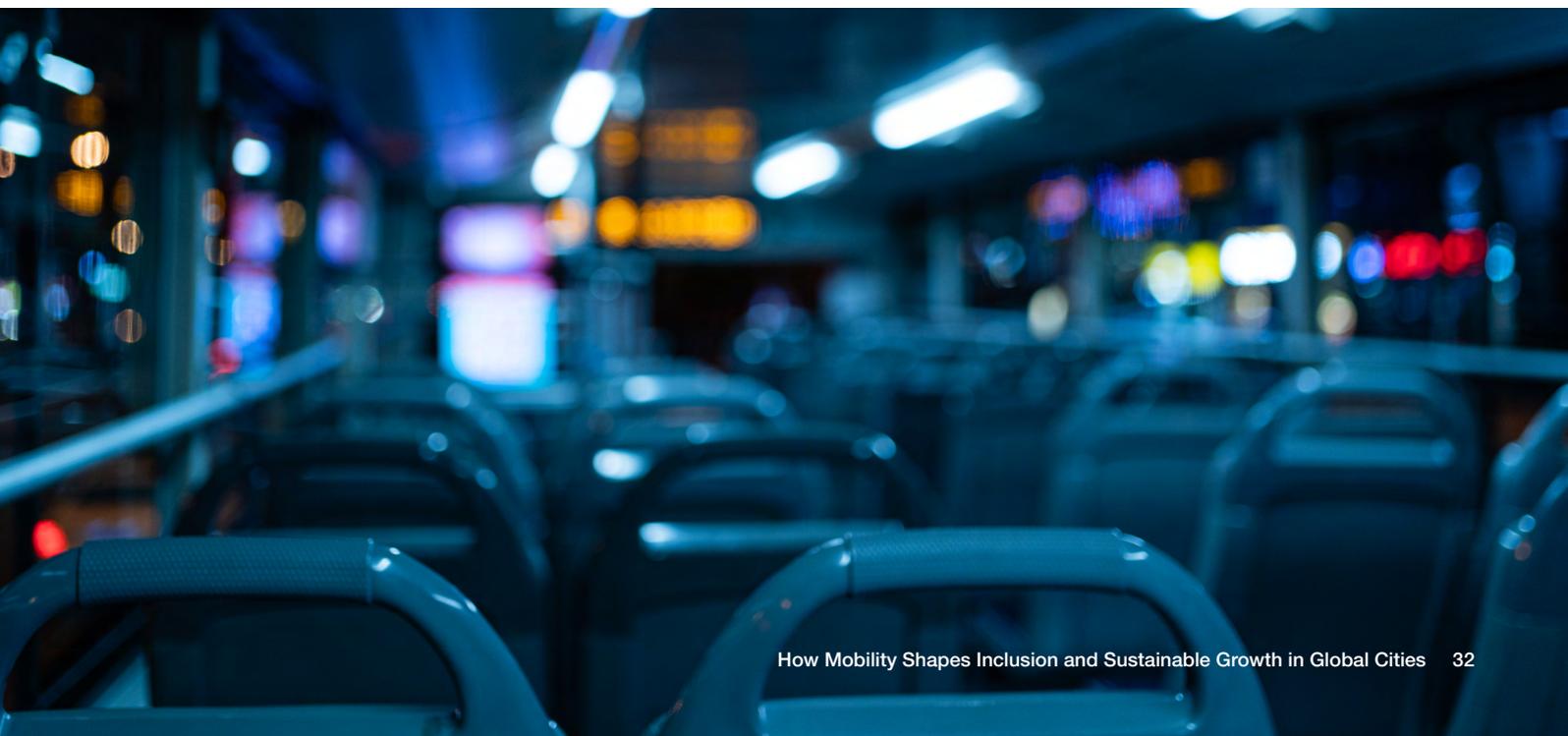
Perhaps the most significant outcome of this analysis of mobility as a tool of socio-economic growth is that cities have numerous tools and technologies at their disposal now. There has never been a better or more necessary time to tackle social inclusion. Overall, the most valuable findings in this research can be categorized as follows:

- To foster social inclusion, cities should consider a broad range of measures, from optimizing supply (for instance, adding new mobility modes) to optimizing demand (locating jobs closer to underserved communities and reducing long queues and other inconveniences) to improving transportation enablers (become digital and data-driven).
- Every city has its own mobility and socio-economic challenges; hence, the starting point – the baseline conditions – of the urban environment must be granularly assessed before being able to determine the appropriate solutions.
- Seemingly small social mobility solutions, for example on-demand shuttles in low-income areas, can have extremely positive outcomes, such as almost doubling accessible jobs for less wealthy communities.
- Other solutions, such as congestion pricing, require very cautious implementation in a fragile mobility ecosystem and must be combined with other levers that provide a real alternative to car-reliant commuters.
- New mobility solutions must be designed with social inclusion principles in mind, guaranteeing access for the unbanked, for individuals not connected to technology and for those who encounter linguistic or cultural barriers.

- The benefits of even well-intentioned mobility measures will be limited if additional opportunities for attractive jobs, education and culture, as perceived by underserved communities, are not also provided.

Broadly speaking, input from a wide range of experts and policy-makers is necessary when trying to determine the right approach to equitable urban transport growth. Mobility planners, city planners, social development specialists, cultural experts and others should play a role in this crucial exercise. This would provide the most complete understanding of current conditions and the best future results – a set of holistic solutions with the backing of an eclectic group of supporters who can be pivotal in helping to merge budgets and funding mechanisms to finance the inclusivity-oriented mobility measures.

Importantly, both qualitative and quantitative insights must be sought to grasp the overall mobility situation. Data-driven conclusions are particularly important to calculate and objectify current mobility conditions and their impact on a community. But qualitative findings ensure that the quantitative results (often correlative and causal) are interpreted correctly. On the qualitative side, besides the feedback from mobility experts and urban policy-makers, the experiences of people affected by existing mobility systems deficits are equally if not more essential.





2.5 Urban transport planning: Obstacles

Although there may be many possible approaches for using mobility as a fulcrum for socio-economic growth and well-being, urban transport planners face three substantial challenges in implementing these solutions:

- The biggest hurdle lies in **resource constraints**. In virtually every city, myriad competing stakeholders are fighting over the allocation of limited funds and workforces that are stretched thin. Cities are good at ongoing operations, but they often struggle to pilot and scale new ideas. A pilot's success is measured mainly by the degree of ridership, but a focus on the long-term benefits to society can make the pilots more meaningful, such as when a pilot connects low-income communities to areas with many jobs.
- The second important problem is the relative **lack of good data and data exchange**. Many urban mobility systems believe they address the needs of underserved populations, but these opinions are often informed by outdated information, excluding crucial data points like the true cost of ridership for the unbanked, transfer time, schedule frequency, performance, waiting conditions and safety perceptions. Deploying a comprehensive data platform also requires the involvement of multiple stakeholders with sometimes competing interests – a huge endeavour.
- The third challenge is that **community engagement** in transportation solutions is clearly declining. This aspect is critical to understand mobility pain points and cultural attributes of affected neighbourhoods. Underserved communities are increasingly sceptical about city agencies and institutions being responsive to them. For example, night and early-morning shifts have been generally overlooked by transit planners and are often inadequately serviced by modes other than cars, even though in many cases they should be the predominant schedules, representing considerable opportunities for socio-economic growth in less-well-off communities.

3

Overcoming the obstacles and facing the future



The known challenges faced by urban transport planners are dwarfed by the unknown issues that they and their cities will have to deal with over the next 30 years. Some cities will grow well beyond today's archetype, and transportation systems will struggle both in trying to keep up with these shifts and in navigating the unexpected. Indeed, the COVID-19 pandemic offers a hint of how staggering unanticipated events can be. In the wake of the virus outbreak, ridership on public transportation around the world fell by more than 90% in many places,⁴ jeopardizing its already fragile business model. To navigate the known and the unknown, five imperatives have been identified that decision-makers worldwide can adopt to support the development of a more inclusive mobility ecosystem in cities:

- 1. Make improving inclusivity a top priority in urban transportation planning and design.** Socio-economic growth is related to access to transportation infrastructure; therefore, improving the mobility situation for underserved population groups needs to be one of the key priorities for decision-makers, and it requires radically innovative ways of thinking.
- 2. Explore how to optimize mobility demand in cities instead of focusing only on supply.** One of the primary conclusions reached during this research is that current systems in many instances are too reliant on traditional public transit options and, in particular, on adding supply in urban areas without determining whether that approach is appropriate. It is tempting to believe that pain points will be addressed organically by increasing the amount of mobility hardware in an urban environment. Enhancing supply only makes a difference in cities with deep and large gaps in their transportation systems whereas, in other circumstances, demand-optimizing solutions, such as the 15-minute city, need to be considered.
- 3. Include radically new approaches in transport planning and design.** The effects of climate change and congestion make it clear that the use of private vehicles is not a workable strategy for improving mobility. During the COVID-19 pandemic, when many people

stopped using public transport, cyclist and driver fatality rates rose.⁵ Urban decision-makers should focus on innovative, shared, on-demand mobility solutions, as well as public transport services and environmentally friendly solutions, and their seamless integration with each other, to provide a real alternative to private car commuting.

- 4. Analyse the preferences, cultural biases and habits of the constituents whom decision-makers seek to serve.** How are they moving, where are they going and what access to opportunity is missing for their individual and collective economic growth? Just as importantly, what are they ready for? What is the collective sentiment on the particular mobility solution being considered, and can they get to where they need to be for personal and economic growth? This type of analysis, which is essential to making mobility innovation and policy human-centred, is an essential precursor for more community engagement in decision-making.
- 5. Run new mobility pilots.** As demonstrated in this study, the small solutions are the ones that can create a significant positive impact, especially for underserved communities. This helps to validate their most urgent pain points. And, by collecting first-hand insights from these communities, the problem of lack of data can at least be reduced. Only solutions that are also accepted by the target communities will ultimately improve the life of thousands of residents. How can these solutions be financed? As demonstrated for Berlin, taking advantage of existing strong mobility solutions can help to identify cross-financing options for inclusivity-related measures.

Clearly, there is still a long way to go before reaching socially inclusive mobility ecosystems in most cities around the world. Based on global benchmarking and the in-depth examination of archetypal urban environments and solutions to the most urgent obstacles conducted for this White Paper, the future of mobility can be viewed with optimism, as it will likely be much more inclusive than it is today. This research aims to contribute to making this a reality sooner rather than later.

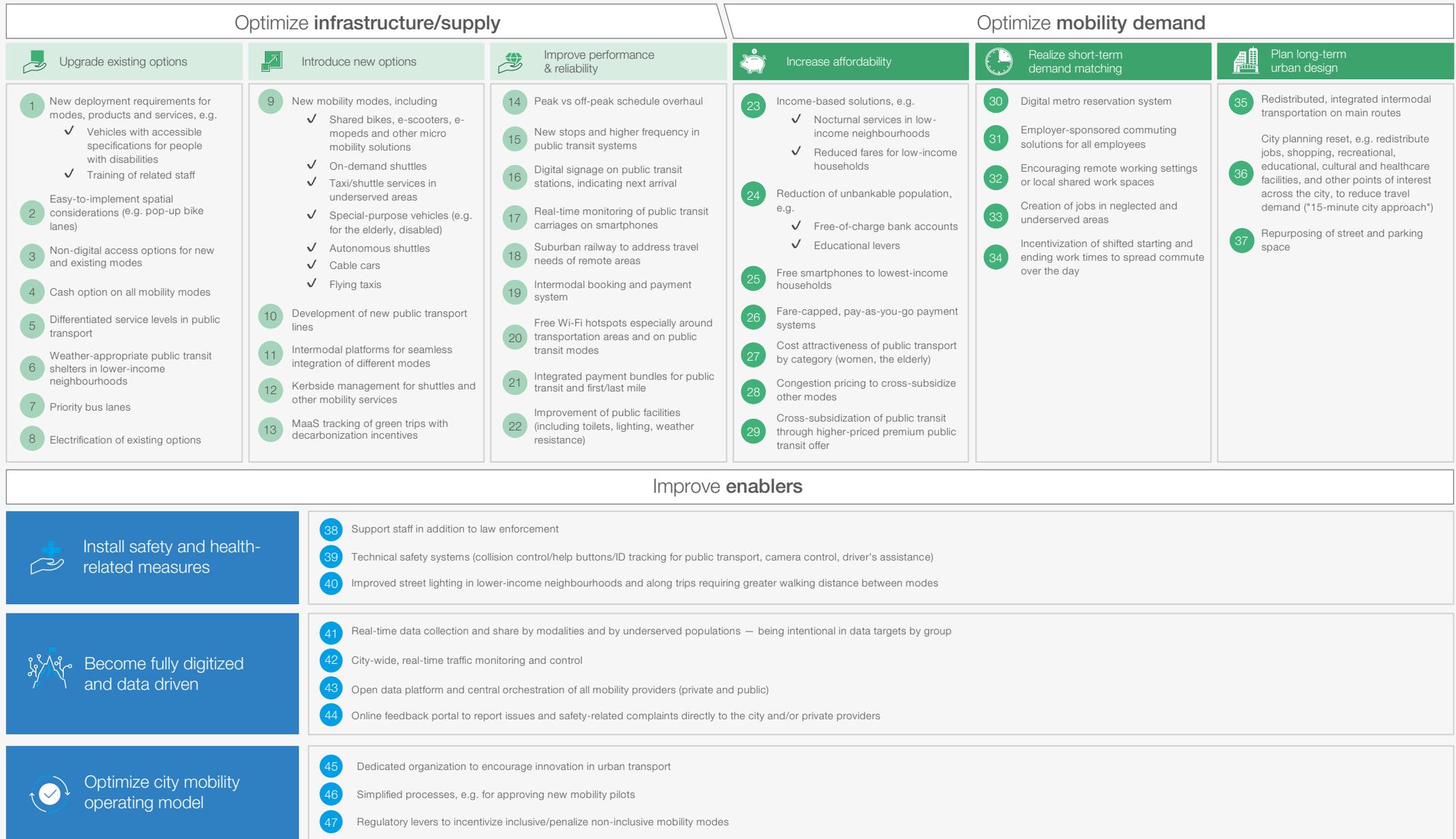


4.1 Framework and methodology for modelling transportation equity metrics

The roadmap designed for mobility improvements that drive social inclusion is based on a universal global solutions framework comprised of more than 40 solutions for consideration by urban and mobility planners, depending on the conditions in their communities. Figure 22 shows the full list of identified solutions.

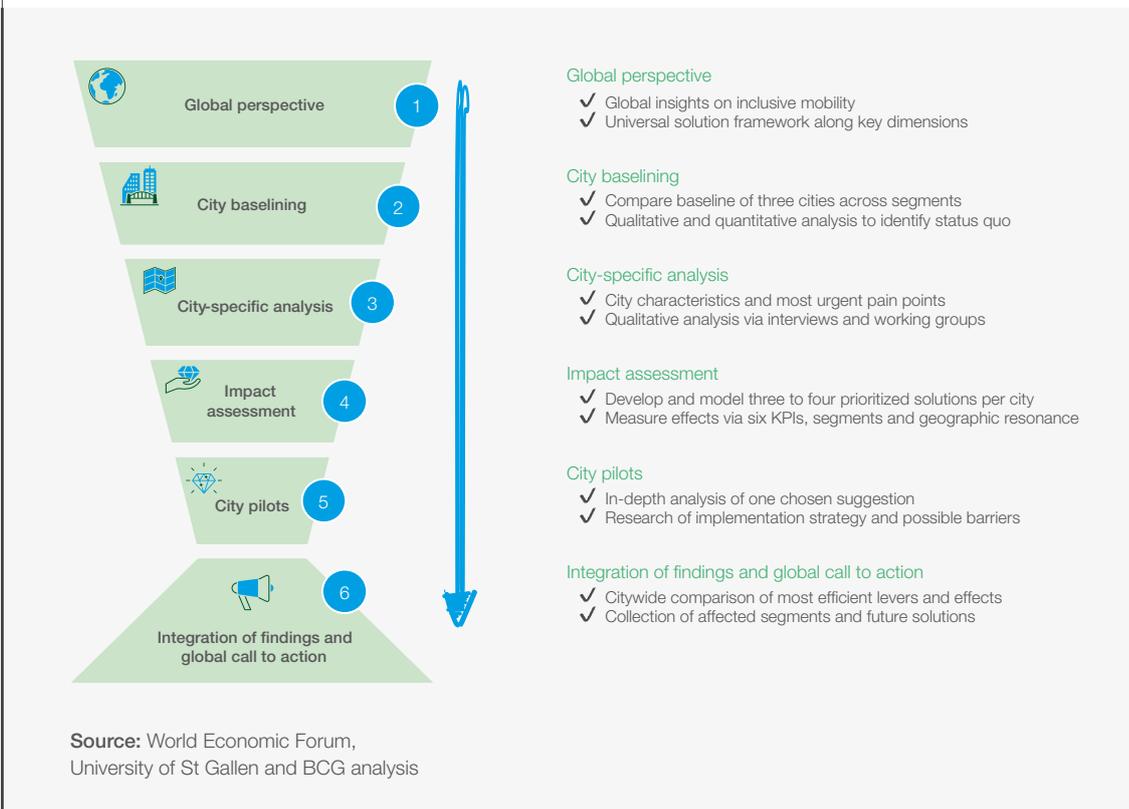
This paper describes how the methodology was used to analyse the mobility patterns and social inclusion solutions in three archetypical cities. This appendix provides a more generic approach (Figure 23) that policy-makers can follow to: 1) measure the correlation between economic prosperity and mobility in their communities; 2) identify the pain points their residents face; and 3) tackle systemic gaps in transport systems.

FIGURE 22 | Framework of over 40 potential solutions under nine dimensions



Source: World Economic Forum, University of St Gallen and BCG analysis

FIGURE 23 Six-step approach to identify the right solutions



1. Think globally to identify the local issues

To the extent possible, decision-makers should begin with a wide-angle perspective before zooming in to their cities and the mobility issues they face. Collecting global insights on inclusive mobility as comparators for measuring success and using the provided framework as a guide will help identify the local issues and allow for categorizing the nature of local problems.

2. Baseline the city, starting with underserved neighbourhoods

Determine the status quo in the city through various lenses, focusing especially on underserved communities and asking key questions, such as: What is the average commuting time? What are the commuting patterns? How many people drive cars? How many people have access to public transit within 10 minutes? The goal is to paint a data portrait of the city that can be used to spark ideas for solutions as well as for comparisons with other cities. The [Mobility Data Operationalization Principles](#) provide more details.

3. Run city-specific analyses and identify the most pressing pain points

Those pain points can be ranked by urgency to address the problem areas identified in step 2 so that the most critical places for initial solutions are delineated. Even though culture, economic model and social make-up create vastly different realities, the challenges faced by underserved communities overlap meaningfully around the world.

4. Review policy levers for possible paths forward and measure potential effects

This White Paper includes over 40 potential policy levers organized across nine pillars for impact. Policy-makers and those engaged in projects can add their own and create their own library of possible paths forward to have a toolbox of potential solutions available for review and consideration.

5. Define and implement pilot solutions

Pilot programmes are essential to get these new mobility policies off the ground. By accurately defining the area of implementation and the pilot's size, and by measuring the affected population segment and the precise operationalization, pilot programmes can provide a rationale to assure necessary and lasting funding. Several sources can cover financial backing, such as the city or federal budget, corporations, or mobility-oriented non-governmental organizations.

6. Integrate findings and a global call to action

When implementing a mobility solution, stakeholders must align on the trade-offs of their decisions to create a clear and shared path forward. By navigating the broad governance system and cooperating with other stakeholders, and by ensuring that incentives and goals are agreed upon, knowledge and resources can be successfully leveraged.

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Endnotes

1. In late January 2021, over 5.5 million people lived more than one hour's travel on public transport from their nearest vaccination centre; 336,000 did not have access to a car. See Burn-Murdoch, John, and Sarah Neville, "Covid vaccination sites out of reach for hundreds of thousands in England", *Financial Times*, 21 January 2021, <https://www.ft.com/content/cf3d5611-7604-46dd-8a85-aade152b09f8> (accessed 16 November 2021).
2. See TomTom, "Chicago traffic", 2019 TomTom congestion index, "Time lost in rush hour – per year", https://www.tomtom.com/en_gb/traffic-index/chicago-traffic (accessed 17 November 2021).
3. The private car driving cost per km in Beijing is ~\$0.6 (estimated from expert interviews and BCG analysis); shared ride cost per km during morning rush hours is \$0.5-0.8 (estimated from Gaode app data). Driving cost includes fuel, insurance, maintenance, depreciation and all other related costs for a typical economic private car owner.
4. Puentes, Robert, "COVID's Differing Impact on Transit Ridership", *Eno*, 24 April 2020, <https://www.enotrans.org/article/covids-differing-impact-on-transit-ridership>; Lazo, Luz, and Justin George, "In a week, the coronavirus razed U.S. transit and rail systems", *The Washington Post*, 22 March 2020, https://www.washingtonpost.com/local/trafficandcommuting/in-a-week-the-coronavirus-razed-us-transit-and-rail-systems/2020/03/22/ca58a88a-6a21-11ea-9923-57073adce27c_story.html (both accessed 16 November 2021).
5. U.S. Department of Transportation, National Highway Traffic Safety Administration (NHTSA), "2020 Fatality Data Show Increased Traffic Fatalities During Pandemic", 3 June 2021, <https://www.nhtsa.gov/press-releases/2020-fatality-data-show-increased-traffic-fatalities-during-pandemic> (accessed 16 November 2021).



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