The Future of Mobility

5, 10, and 20-Year Outlook in a Global Context

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Introduction and Key Drivers

The ways people and goods move are poised for **unprecedented change** over the next two decades. In the United States – and globally – technological innovation, shifting human behaviors, urban planning, and policy pressures are converging to transform mobility. Today's car-centric, fossil-fueled transport system faces **disruption** from electric vehicles (EVs), autonomous driving, Mobility-as-a-Service (MaaS) platforms, and new modes like drone delivery and hyperloop. At the same time, social trends (e.g. **remote work**, an aging populace, climate migration) and global exemplars (China's bullet trains, Europe's walkable cities, Africa's leapfrog into e-mobility) are reshaping travel demand and preferences. Policymakers are pushing for sustainability and safety, while infrastructure and energy systems must adapt to support emerging modes.

Table 1 – Mobility Evolution Across Time Horizons (U.S. Focus with Global Inputs).
Sources: Compiled from industry analyses, consumer surveys, and futurist scenario studies (mckinsey.com, mckinsey.commckinsey.com). (See detailed citations in sections below.)

Aspect	5-Year Outlook (2025–2030)	10-Year Outlook (2030–2035)	20-Year Outlook (2045)
Personal Vehicles & EVs	EVs ~30–50% of new car sales (reuters.comnrel.gov); ~27M EVs on U.S. roads (pwc.com). Widespread Level 2+ autonomy; ~12% of new cars with Level 3+ self-driving features (mckinsey.com). Younger adults driving less (pro.morningconsult.com).	EVs dominant in new sales (~60% (reuters.com)); many cities enforce zero-emission vehicle zones. Level 4 autonomous driving common on highways; robotaxis operating commercially in major cities. Private car ownership peaks then declines in urban areas as shared services and micromobility grow.	Near full electrification of new vehicles; legacy gasoline cars largely phased out. Fully autonomous vehicles (Level 5) available for mass market, possibly making up >30% of the fleet (reddit.com). Personal car ownership in cities becomes optional – on-demand autonomous EV fleets provide door-to-door service.

Aspect	5-Year Outlook (2025–2030)	10-Year Outlook (2030–2035)	20-Year Outlook (2045)
Shared & Public Transit	Transit ridership recovering post-pandemic; bus and train fleets increasingly electric. Mobility-as-a-Service apps integrate transit, rideshare, micromobility (e.g. Berlin's Jelbi platform (mckinsey.com)). Pilot autonomous shuttles on fixed routes. Some U.S. cities adopt **congestion pricing** and car-lite street designs (inspired by Europe).	Major transit expansions in progress (some new urban rail/BRT lines). Widespread use of MaaS platforms for trip planning/payment across modes. Autonomous buses in controlled settings; **on-demand shuttles** supplement fixed routes. High-speed rail projects (e.g. California) reach initial operating stages. U.S. cities emulate global leaders: more pedestrian zones, "15-minute city" planning (e.g. Paris's model (mckinsey.com)).	Integrated mobility ecosystems: seamless multimodal travel. City centers largely car-free, transit and micromobility are primary modes for urban dwellers. Autonomous, electric minibuses and robo-taxis provide first/last-mile links. Potential launch of **hyperloop** or ultra-high-speed intercity routes if proven (following international successes). Public transit fully decarbonized and smart-optimized.
Freight & Logistics	Rapid growth in e-commerce logistics; electric delivery vans and drones in pilot use. **Autonomous trucks** testing on highways – expected commercial launch on select routes by late-2020s. Freight companies address driver shortages with automation (mckinsey.com, mckinsey.com). Warehouse robotics and supply chain AI improve efficiency.	Widespread **EV adoption in trucking** (some hydrogen fuel for heavy trucks); autonomous trucking fleets in operation on major interstates (up to ~13% of US heavy trucks autonomous by 2035 (mckinsey.com, mckinsey.com)). Drone delivery networks in some regions for high-value or urgent goods. Increased rail and intermodal freight investment (learning from global logistics hubs).	Highly automated logistics: autonomous trucks common nationwide for long-haul, with human drivers mainly for first/last-mile or oversight. **Drone delivery** and sidewalk robots routine for last-mile in suburbs and cities. Freight moved via smart, green infrastructure; possibly initial **hyperloop freight corridors** if technology succeeded abroad. Supply chains are resilient, with AI managing traffic and routing in real time.

Aspect	5-Year Outlook (2025–2030)	10-Year Outlook (2030–2035)	20-Year Outlook (2045)
Air Travel & Beyond	Air travel demand surges back; industry pursues sustainable aviation fuels. **Electric aviation** debuts: eVTOL air taxis begin limited services in pilot cities (targeting 2025–2030 launch). Small electric airplanes enter short regional routes. Space tourism is embryonic (Blue Origin/Virgin Galactic suborbital flights) – exclusive to the wealthy.	Many short-haul flights served by electric/hybrid aircraft (improving battery tech extends range ~200–300 miles). **Urban Air Mobility** matures: dozens of cities have eVTOL taxi networks for premium travel to airports or across town. Autonomous air traffic management (AI-guided) for drones and air taxis. Hyperloop prototypes possibly operational internationally, informing U.S. planning. Space tourism more routine but still niche (orbital hotel visits for ultra-rich, market ~$5B (weforum.org)).	Air mobility transformed: A significant share of <500-mile trips shift to electric aircraft or hyperloop (if implemented) reducing short-hop airline traffic. **Supersonic or hypersonic travel** may return for long distances (potential point-to-point suborbital rocket flights, though costly). Air taxis ubiquitous in metro regions, integrated into transit hubs. Space tourism and even point-to-point rocket travel remain limited to niche markets, but space-tech spinoffs improve aviation.
Behavior & Culture	Remote/hybrid work solidifies (up to 20–25% of workdays from home (mckinsey.com)), reducing daily commutes and flattening peak travel demand. Younger generations delay driving and car ownership (pro.morningconsult.com), favoring shared mobility and urban living. **Climate awareness** grows: consumers seek greener travel options (46% already shifting to sustainable products (mckinsey.com)). Early retirements and aging drivers boost demand for safer vehicles and local transit options.	Urban migration patterns adjust: some climate-exposed regions see population outflow, "climate safe" cities grow. Commuting patterns permanently changed by work-from-home tech (VR collaboration by 2035 may further reduce business travel). Strong public preference for walkable, mixed-use neighborhoods – driving policy changes in zoning and street design. Generational ethos values access over ownership in	Societal transformation: Entire city designs revolve around accessibility, not personal cars. The concept of "driving" evolves as many people under 30 may never need a driver's license if autonomous shuttles are pervasive. An **aging populace** (22% 65+ by 2040 (ncoa.org)) relies on autonomous pods and on-demand services for independence. Climate migration significantly redraws population maps –

Aspect	5-Year Outlook (2025–2030)	10-Year Outlook (2030–2035)	20-Year Outlook (2045)
		mobility (subscriptions, sharing common).	e.g. parts of the Southwest and coastal areas see declines while northern cities expand – altering where infrastructure is built.

Below, we provide an in-depth briefing across **three time horizons** – the tactical near-term (next 5 years), strategic mid-term (10 years out), and speculative long-term (20 years out) – examining developments in each major mobility domain. Each section integrates technological trends, behavioral and cultural shifts, policy factors, and global influences shaping the U.S. mobility landscape. Key uncertainties and **constraints vs. opportunities** are noted to inform strategic planning. All projections are **scenario-based** estimates intended to guide researchers in envisioning plausible futures, not to prescribe exact outcomes. Citations are provided throughout to enable deeper investigation into data and emerging innovations.

Near-Term Tactical Horizon (2025–2030)

In the next five years, many current trends gather momentum. This period will largely set the foundation for longer-term transformation. We'll see **incremental but significant changes**: electric vehicles and micromobility will become mainstream options, autonomous tech will move from testing to early deployment, and pandemic-era shifts (like remote work) will settle into new norms. Policy initiatives (e.g. the 2021 infrastructure law and global climate pledges) begin to bear fruit in charging networks and transit projects. However, legacy systems (millions of gas cars, traditional road infrastructure) still dominate, so changes remain in a transitional phase. Below is a breakdown of what to expect by 2030:

Personal Transport & Micromobility (2025–2030)

- Electric Vehicle surge: The U.S. is on a **steep EV adoption curve** this decade. By 2030, roughly **30% of all new cars sold in the U.S. could be electric** (if automakers meet targets) (reuters.com). That's up from only a few percent in 2020. In raw numbers, the EV fleet is projected to jump to about 27 million EVs on U.S. roads by 2030 (pwc.com). Major drivers are falling battery costs, automakers rolling out dozens of new EV models,

and federal incentives. Notably, if all manufacturers hit their electrification goals, *between 42% and 58% of global car sales could be electric by 2030* (iea.org) – indicating the U.S. market is catching up to Europe and China where EV policies are very aggressive. This rapid growth poses challenges: **electricity demand** will rise steeply – EV charging could add ~100–185 TWh load by 2030 (roughly 2.5–5% of U.S. consumption) (reuters.com). Utilities will need new grid management tools and expansion to handle peaks, but in the near term, strategies like smart charging and vehicle-to-grid integration can mitigate stress (reuters.comreuters.com).

- Autonomous features rollout: Fully self-driving personal cars won't be common by 2030, but **advanced driver-assistance and partial automation will**. Luxury and mid-range vehicles are increasingly equipped with Level 2+ systems (adaptive cruise, lane keeping) and a few with Level 3. **By 2025**, some high-end cars in North America and Europe will offer Level 3 or 4 self-driving on highways under certain conditions (mckinsey.com, mckinsey.com). McKinsey estimates that by 2030 about **12% of new cars sold globally will have Level 3 or higher autonomy (**mckinsey.com) – meaning the car can handle driving tasks in specific environments while the human can disengage. In the U.S., that could translate to a few million privately owned "mostly self-driving" cars, plus growing fleets of experimental **robotaxis** in cities. For example, GM's Cruise and Alphabet's Waymo are already running limited autonomous ride-hail services in San Francisco, Phoenix, etc., and are aiming to scale to more cities in the late 2020s. We will also see more **ADAS safety tech** (automatic emergency braking, blind spot assist) across the fleet, slowly improving road safety.

- Micromobility mainstreaming: Electric bikes, scooters, and other micromobility options will firmly entrench themselves in urban transportation. Nearly **one-third of Americans plan to increase use of micromobility or shared mobility in the next decade (** mckinsey.com), and this shift begins now. By 2025–2030, most U.S. cities will have robust e-scooter and e-bike sharing programs (many already do), better bike lanes, and regulations to manage these modes. The **global micromobility market**, valued around $180 billion in 2022, could more than double to $440 billion by 2030 (mckinsey.com), indicating heavy innovation and investment. **Young people and urban dwellers** are driving this trend – Gen Z especially is less car-dependent. Survey data shows Gen Z adults are **less likely to have driver's licenses and drive less frequently than older groups** (pro.morningconsult.com). Instead, they often opt for e-bikes, scooters, or app-based rides. As a result, cities will continue adding bike lanes and scooter parking, and some will follow the lead of places like Paris and **Chengdu** (which is building a 1,920 km urban bike lane network by 2025, en route to 17,000 km by 2040 (mckinsey.com)).

- Shifts in car ownership behavior: The long-held American norm of auto ownership is softening in this horizon, especially in metro areas. Many younger consumers are content to **not own a car** and use a combination of transit, biking, and ride-hailing. In a 2022 McKinsey survey, nearly **half of respondents (46%) globally said they are open to replacing their private vehicles with other transport modes in the coming decade** (mckinsey.com). This sentiment will start reflecting in U.S. cities by 2030 – e.g., more households choosing to go car-free or car-light (one car instead of two). Car-sharing services (like Zipcar or peer-to-peer car rentals) and subscription models may expand to offer access when a personal vehicle is needed. Still, in much of suburban and rural America, car ownership remains important in this period. Overall vehicle miles traveled (VMT) may stay flat or even dip slightly in the late 2020s, as remote work reduces commuting and some urbanites forego cars, balancing out growth in other areas.
- Infrastructure for EVs and micromobility: To support these trends, the late 2020s will see **massive build-out of charging stations** – the Bipartisan Infrastructure Law (2021) allocates $7.5B for a national EV charger network, targeting 500,000 chargers. By 2030, highway corridors and cities should be much better equipped with fast-chargers, alleviating range anxiety. Likewise, more **bike/scooter infrastructure** (protected lanes, parking, charging for e-bikes) will be installed. Some U.S. cities have already eliminated minimum parking requirements in new developments (e.g. San Francisco) to encourage alternative transport (mckinsey.com). Expect more zoning changes that reduce parking and increase charging facilities and bike amenities.

Shared Mobility & Public Transit (2025–2030)

- Ridership recovery and evolution: Public transit systems in the U.S. are rebounding from the pandemic-era slump, but commuting patterns have changed. By late 2020s, **ridership on many urban transit lines will approach pre-2020 levels** on average, though with different peaks (less 9-to-5 rush hour, more all-day usage due to hybrid work). Transit agencies are adapting with more **flexible services**, e.g. on-demand shuttles and microtransit to serve dispersed work patterns. There is increased emphasis on **integration**: cities will tie together buses, subways, bike-share, and ride-hail into unified payment apps, mirroring MaaS (Mobility-as-a-Service) successes in Europe and Asia. For instance, by 2025 Washington D.C.'s SmarTrip or similar apps may start incorporating shared bikes and Uber/Lyft options alongside metro info, inspired by platforms like Jelbi in Berlin (mckinsey.com) that already integrate various modes.
- Electrification of transit: A major tactical shift is the greening of transit fleets. **Electric buses** are being adopted in dozens of U.S. cities, thanks to federal funding and falling

costs. Within 5 years, many transit authorities will have committed to 100% zero-emission bus purchases. Expect hundreds of new e-buses on the roads (states like California mandate all new buses be zero-emission by 2029). Some **electric commuter trains** (or battery/diesel hybrids) will also roll out on select routes. This mirrors global trends – for example, **India aims for 40% of buses to be electric by 2030 (**itdp.org) and China already has cities (like Shenzhen) with fully electric bus fleets. The U.S. will lag slightly but make big progress this period in cleaning transit emissions.

- Autonomous and AI-managed transit: By the late 2020s, **autonomous shuttles and buses** will be in pilot service. Several U.S. campuses and small downtowns already host low-speed driverless shuttles. This will expand cautiously: cities like Houston, Jacksonville, or Phoenix may deploy autonomous shuttles on specific routes or for first-mile/last-mile connections to transit hubs. Additionally, **AI-powered traffic management** will start to benefit transit. Smart signals giving priority to buses at intersections, and algorithms optimizing routing and schedules in real time, can make buses faster and more reliable. These improvements draw on examples abroad – e.g., **Hangzhou, China** uses AI to dynamically control traffic lights and has reduced congestion and improved bus speeds.

- Urban design favoring transit and active travel: Influenced by European cities, some U.S. municipalities are taking tactical steps to prioritize people over cars. **Congestion pricing** is likely to launch in New York City in 2024/25 (charging vehicles entering Manhattan's core) – by 2030, we'll have data on its effects (expected to cut traffic and raise transit use). Other cities (perhaps San Francisco, LA) will consider similar measures or expanded tolling. Many downtowns will repurpose street space: expect more **bus lanes, bike lanes, and pedestrian-only zones**. For example, Oslo and Paris have removed parking to make plazas and bike paths (mckinsey.com, mckinsey.com); New York has pedestrianized parts of Broadway. By 2030, these redesigns will make transit and walking more pleasant options, nudging people out of cars for short trips. **"15-minute city"** concepts (accessing daily needs within 15 min walk/bike) are explicitly being included in some city strategic plans, inspired by Paris's initiative (mckinsey.com).

- Funding and policy environment: Significant federal funding from the 2021 Infrastructure Investment and Jobs Act (IIJA) and 2022 Inflation Reduction Act flows into mobility through the late 2020s. This means **upgraded transit infrastructure** (repairing older systems, extending lines), **rail projects** (e.g. finally advancing Northeast Corridor improvements, initial construction of high-speed rail in California and perhaps Texas or Florida), and grants for innovations. The law also boosts safety and equity programs – e.g. a $1.44B annual "Transportation Alternatives" set-aside for bike/pedestrian projects through 2026 (mckinsey.com). We will see the fruits of these investments by 2030: safer

bike networks, pilot programs for low-income fare subsidies, and new passenger rail options under development. However, political swings remain a risk – if administrations change, priorities or funding streams could shift. In the near term though, **bipartisan support for infrastructure is solid**.

Freight & Logistics (2025–2030)

- E-commerce logistics boom: The near term features **booming delivery volumes** as online shopping remains high. This puts pressure on urban logistics – more vans, more drop-offs. Companies respond by electrifying and optimizing: major delivery fleets (Amazon, UPS, FedEx) are deploying **electric delivery vans** at scale by 2025–2028 (Amazon has started rolling out Rivian-built EV vans). These EVs improve urban air quality and reduce fuel costs. We'll also see more **cargo bikes** in dense areas – already UPS and DHL use e-cargo bikes in some U.S. cities, a trend borrowed from European centers. City policies might encourage this (allowing bike deliveries in bike lanes to avoid truck congestion). Additionally, **drones for delivery** begin limited service. By 2025, companies like Wing (Alphabet) and Amazon Prime Air are running pilot drone delivery in suburbs or small towns for lightweight parcels (medical supplies, fast food orders, etc.). Over five years, these remain niche due to FAA regulations and airspace integration challenges, but tech and public acceptance will be proven in select communities.

- Autonomous trucking trials: The late 2020s are a **pivotal testing period for self-driving trucks**. Several companies (TuSimple, Waymo Via, Aurora, Plus.ai, etc.) have pilot autonomous semi-trucks already hauling freight in states like Texas and Arizona. By 2025, we expect the first **commercial autonomous truck routes** to be operating in hub-to-hub service (likely on relatively flat, warm-weather interstates in the Sun Belt). According to industry research, major OEMs plan to have the first production autonomous trucks on roads in the **second half of the decade (2025–2030)** (mckinsey.com). Adoption will start slowly – possibly as *"driver-out"* runs between logistics hubs at night when traffic is light. The business case is strong: autonomous trucks could save on driver costs and run longer hours, offering big efficiency gains and a market of ~$600B by 2035 (mckinsey.com). By 2030, perhaps **a few percent of trucks in the U.S. fleet will operate autonomously** in controlled settings. The **driver shortage** (projected 160k shortfall by 2030 in the U.S.) (mckinsey.com) provides incentive to automate. That said, human drivers will still handle most local and complex deliveries in this horizon. Key milestones to watch: safety validation (public trust after millions of test miles), updates to regulations permitting driverless operation across state lines, and the

building of **"autonomous truck ports"** at highway exits where trailers can be swapped from human-driven local trucks to autonomous rigs for long haul legs.

- Freight rail and intermodal: The U.S. freight rail system remains vital for bulk goods, but has not been optimized for smaller-scale intermodal freight as in Europe or Asia. In the late 2020s, there may be renewed interest (for efficiency and climate reasons) in shifting more freight from trucks to rail where possible. Federal grants from the infrastructure law support upgrading rail infrastructure and intermodal facilities. Some ports and logistics companies will invest in faster container transfer and **integrated trucking-rail operations**. Also, **automation in rail** could advance (e.g. automated train operations in railyards). However, any major shift is slow; trucks still dominate freight. One emerging concept is the **"hyperloop for cargo"** – startups might test moving shipping containers in vacuum tubes. While purely experimental now, by 2030 we might have a prototype cargo hyperloop (for example, Virgin Hyperloop refocused on cargo pods after 2022). If such tests succeed abroad (Europe, Middle East), it could set the stage for U.S. adoption later.

- Logistics AI and optimization: The near term will also see **software-driven gains** in freight efficiency. Routing algorithms (using real-time traffic, weather, and IoT data from trucks) can cut delivery times and fuel use. Warehouse automation (robots picking goods, AI vision for sorting) will be widespread by 2030 in large fulfillment centers. The supply chain disruptions of early 2020s taught companies to build more resilience – so expect more localized inventories (shorter supply lines) and use of predictive AI to anticipate demand surges or delays. All this will gradually reduce costly inefficiencies (e.g., trucks running empty). By 2030, many trucks will be **connected vehicles** continuously feeding data to cloud platforms for fleet management. This connectivity also raises **cybersecurity concerns** (protecting commercial fleets from hacking will be an emerging need, addressed via new standards and safeguards in this period).

Air Travel and Aviation (2025–2030)

- Air traffic growth vs. sustainability: Despite climate concerns, air travel is expected to grow significantly through 2030. A recent forecast predicts a **60% increase in international travelers by 2040** (thinkwithgoogle.com), and much of that growth trajectory starts now: by late 2020s, global tourism and business travel rebound strongly from COVID-19. U.S. airports will see volumes approaching record highs. For example, Airports Council International projects passenger traffic rising ~5.8% annually; by 2040 over 19 billion passengers worldwide per year (oliverwymanforum.com) (up from ~9 billion pre-pandemic) – implying by 2030 we'll be well on that curve. U.S. airlines and airports are expanding capacity (new runways, more gates, improved terminals) to handle this.

However, **aviation emissions** are under scrutiny. In the next 5 years, we'll see the industry invest heavily in **Sustainable Aviation Fuel (SAF)** (biofuels that cut lifecycle emissions) and more efficient aircraft. Airlines like United and Delta have SAF usage targets for 2030 and are upgrading fleets to newer planes that burn less fuel per seat. The **first electric and hydrogen aircraft** for niche uses will also debut this period (see below), but conventional jet travel remains the norm in 2030.

- Electric aviation and eVTOLs: A major exciting development is the emergence of **electric flight for short distances**. By around 2025–2026, several startups aim to certify small **electric airplanes** (e.g. 9-passenger commuter planes like Eviation's Alice) for regional routes ~100–250 miles. These could serve short hops where turboprops fly today – expect initial operations in places like the Pacific Northwest or New England linking small cities. Concurrently, the **eVTOL (electric vertical takeoff and landing) air taxi** sector plans to launch services by 2024–2025. Companies like Joby Aviation, Archer, and Beta Technologies have prototype air taxis (typically 4-5 seat tilt-rotor or multirotor craft) and are working with the FAA for certification. If timelines hold, by 2028 **we may see air taxi services in a few U.S. metro areas** (likely starting in Los Angeles, Miami, or Dallas which have supportive partners). These will at first be demonstration services – think helicopter-like rides from airports to downtown or between suburbs – and priced for premium customers. However, they mark the start of **urban aerial mobility**. NASA and FAA are developing traffic management systems (UTM) to handle low-altitude drone and eVTOL traffic safely. Globally, this is an area of intense competition: **European and Asian cities** (Paris, Singapore, Dubai) also aim for eVTOL services by the 2024–2030 timeframe, possibly even ahead of the U.S. in some deployments.

- Airport innovation: In the near term, airports themselves are changing to accommodate new tech and improve throughput. Expect more automation in passenger processing (biometric boarding gates, AI-powered security scans for quicker clearance). Some U.S. airports are linking with city transit (e.g. the new People Mover train at LAX opening ~2024 will connect to metro rail). By 2030, **intermodal hubs** that connect flights with high-speed trains or hyperloop might be planned (in concept if not built) – inspired by places like Frankfurt or the proposed **hyperloop connection in Venice by 2030** (theengineer.co.uk). Also, **electric aircraft infrastructure** will appear: charging or battery swap stations at regional airports for commuter e-planes, and vertiports (eVTOL landing pads) atop parking garages or transit stations in cities. Some airports may also integrate **drones** for logistics (e.g. carrying documents or parts across airfield) to streamline operations.

- Hyperloop development: While not air travel per se, hyperloop aims to compete with short flights. Between 2025 and 2030, hyperloop technology will move from concept to the

first full-scale tests. **Virgin Hyperloop** completed a small-scale passenger test in 2020 and in 2021 announced a goal of safety certification by 2025 with commercial operations by 2030 (virgin.com). Several countries are pursuing projects: e.g., an Italian project for a 10-km hyperloop (Venice to Padua) got a green light (theengineer.co.uk), and **the Netherlands is building a Hyperloop test center** in Groningen (aljazeera.com). In the UAE, Dubai's Road Transport Authority has partnered to study a hyperloop to Abu Dhabi (potentially in the 2030s). By the end of this decade, we will know if hyperloop is viable: likely one or two pilot routes internationally will be under construction or early operation. The U.S. has proposals (like a Missouri route or the Midwest Hyperloop), but none have broken ground. If global projects succeed, the early 2030s could finally see a U.S. hyperloop project move forward; if they falter, hyperloop might remain speculative. **In summary for this horizon**: hyperloop remains **in the prototype/testing stage** through 2030 – a technology to watch, but not yet part of the regular mobility ecosystem.

- Space tourism dawn: Another "out there" domain is civilian space travel. By 2025, companies such as Blue Origin and Virgin Galactic will have flown paying passengers on suborbital hops (a few minutes of weightlessness at ~$250k-$500k per ticket). Indeed, this already started in 2021–22 (Bezos and Branson themselves flew). Through the late 2020s, these flights will increase in frequency, though still limited to the wealthy and adventure seekers. We might see SpaceX fly a private crew around the Moon (the **dearMoon** project is slated for 2024 with artist Yusaku Maezawa). **By 2030, space tourism is a nascent but growing industry** – perhaps dozens of people traveling above the Kármán line yearly. Morgan Stanley projects the *overall space economy* (which includes satellites, etc.) could reach $1 trillion by 2040 (uftourism.org); within that, **space tourism might be a modest $4–6 billion market by 2035** (weforum.org). In this near term, the key impact on mobility is mainly inspiration and R&D: space tech advancements could trickle down to aviation (e.g., better materials, high-speed craft). Also, the concept of **point-to-point suborbital travel** (New York to Tokyo in ~1 hour via rocket) is floated by SpaceX, but won't be near reality until much later (if ever, due to extreme cost and sonic boom issues). So for now, space tourism is more science fiction in everyday impact – a headline-grabber rather than a mass transportation mode.

Behavioral, Cultural & Policy Trends (2025–2030)

- Remote and hybrid work's lasting impact: By the late 2020s, it's clear that remote work is not a passing fad. Many companies and employees have settled into a hybrid work model, where perhaps 2–3 days a week are work-from-home. Up to 25% of workers in advanced economies could regularly work from home several days per week going

forward (mckinsey.com), compared to about 5% before 2020. This has direct effects on mobility: peak commuting hours are less intense, and transit agencies may adjust by focusing less on peak-only service and more all-day frequency. Highways might see slightly lower rush-hour traffic than historical trends would predict, but possibly more mid-day traffic from flexible schedules. Additionally, with remote work an option, some people have moved farther from offices – living in exurbs or smaller cities, which can increase car travel for non-work trips. Others relocated to more rural or leisure destinations (the "Zoom town" effect). Over 5 years, we'll see net effects: likely lower daily commute volumes, but mixed impacts on total VMT. Policymakers may use this window to introduce demand management (like staggering work hours) to prevent a return of severe congestion.

- Demographic shifts and mobility needs: The U.S. population is aging – by 2030 all Baby Boomers (born ≤1964) will be 65+. That means 1 in 5 Americans will be 65 or older by 2030 (coopercenter.org). This "silver tsunami" influences travel behavior: older adults drive less (especially after 75, many stop driving), and they have more medical and off-peak trips. There will be increasing demand for senior-friendly transportation: dial-a-ride shuttles, accessible transit (low-floor buses, etc.), and eventually autonomous vehicles as a mobility aid. Car manufacturers in the near term will incorporate more driver assistance targeting senior drivers (collision avoidance, lane keep, etc. to enhance safety). Culturally, expect growing advocacy for designs that help those who can't or shouldn't drive – e.g., more golf-cart or low-speed vehicle use in retirement communities, and policies supporting aging in place via mobility services. On the other end of demographics, Gen Z and young Millennials in their 20s will shape preferences – as noted, many are delaying getting a license and are less car-focused (pro.morningconsult.com). They prioritize digital convenience and climate impact, which boosts shared mobility and transit use. The near-term result is a somewhat divided market: older Americans clinging to personal cars (but needing safety tech), younger Americans more open to post-car lifestyles.

- Climate change and resilience: The late 2020s unfortunately will bring more visible climate impacts – extreme weather, hurricanes, wildfires – which in turn affect mobility. We may see climate-driven migration begin to accelerate: already, an estimated 3.2 million Americans have moved from vulnerable areas due to climate impacts (climatenow.com). Studies suggest rising sea levels could displace 13 million Americans in the long run (climatenow.com), with millions more from wildfire zones. In the next 5 years, this translates to noticeable population shifts: e.g., some coastal residents in Florida or North Carolina relocating inland, or Westerners leaving high-risk wildfire areas. Sun Belt vs. Rust Belt migration could partially reverse, with previously declining northern cities (Detroit, Buffalo, etc.) marketing themselves as climate refuges. For transportation,

these shifts mean some regions will face infrastructure strain (growing cities needing more transport capacity), while others grapple with damaged or underutilized infrastructure. There's a new emphasis on resilient infrastructure design: rebuilding roads, rails, and bridges to withstand floods, heat, and storms. Federal funds in this period will go into hardening critical transportation corridors (e.g., elevating highways, cooling materials for rails). Policymakers also increasingly integrate climate risk into planning – for instance, not building new highways in flood-prone zones, and focusing on transit-oriented development in safer areas. We could also see fuel shortages or high gas prices at times due to climate or geopolitical issues, which would further push EV adoption and telecommuting as adaptive responses.

- Policy and regulation trends: In the near term, many policies encouraging cleaner, safer mobility kick in. By 2030, CAFÉ standards (fuel economy) will be very high for new cars, effectively pushing automakers toward EVs to comply. The government has set a goal of 50% zero-emission vehicle sales by 2030, and while not mandatory, this aligns with automaker plans (economics.td.com). At state levels, California's mandate for all new vehicles to be zero-emission by 2035 is looming, influencing national market offerings. Cities continue to experiment with regulations to curb car use: e.g., low-emission zones (some U.S. cities might copy London's model of charging or banning older vehicles downtown), parking policy reforms (like eliminating minimums or imposing maximums, as seen in San Francisco (mckinsey.com)), and incentives for biking and transit (such as employer transit pass programs). Safety regulations are also on the agenda: there's a push for Vision Zero (eliminating traffic deaths). Expect by 2030 new cars to be required to have tech like intelligent speed assist or drunk-driving prevention systems (NHTSA is working on alcohol-detection interlocks for new cars by 2026 per the infrastructure law). Data privacy and cybersecurity laws may emerge to govern connected cars and location data, as the public becomes aware of how vehicles and phones generate mobility data. And notably, infrastructure governance may see innovation – perhaps more regional coordination to manage issues like traffic or transit across metro areas (following examples like Transport for London's integrated control of transit, roads, etc.). Overall, policy in this period is actively trying to steer behavior (toward cleaner, safer modes) without drastically upending personal choice.
- Global influences in the near term: U.S. mobility in the next 5 years will be visibly influenced by what's happening abroad:
    - China's mobility drive: China already has over 300 million vehicles on the road and is a leader in EVs and high-speed rail (mckinsey.com, mckinsey.com). By 2030, China will likely dominate EV production (making EVs cheaper globally) and have autonomous tech and battery innovations that U.S. companies adopt or

compete with. Also, China's massive high-speed rail network (aiming for 70,000 km by 2035) stands in stark contrast to U.S. intercity rail. This has begun to spur conversations in the U.S. about catching up; the late 2020s might see, for instance, cooperation with Japanese or European firms to build high-speed rail lines in California or the Northeast, emulating China's success domestically and abroad.

- European example: Many European cities by 2030 will have banned fossil-fuel cars in city centers and achieved high transit/biking modal shares (allianz-partners.com, allianz-partners.com). Policies like France's ban on short domestic flights where train alternatives under 2.5 hours exist (mckinsey.com), or Germany's €49 nationwide transit pass (mckinsey.com), serve as case studies. U.S. policymakers and advocacy groups often cite these – e.g., California considered a bill to ban short-haul flights in favor of rail similar to France. Whether such policies pass in the U.S. by 2030 is uncertain, but the cultural influence is there: younger Americans especially ask "why can't we have trains like Europe or buses like Germany?". This increases public support for transit funding and livable streets. European carmakers (VW, BMW, Volvo, etc.) are also aggressively shifting to EVs, meaning the U.S. car market will be flooded with attractive EV options by 2030 due to global mandates, which accelerates the transition here.
- Emerging markets leapfrogging: Places like India and many African countries are pursuing unique mobility paths – e.g., India's target of 80% electric two-wheelers by 2030 (itdp.org) and startups across Africa deploying electric motorbikes and solar charging for them (africainsight.co.ke, africainsight.co.ke). In the near term, some of these innovations (cheap electric motorcycles, for instance) could find a niche in the U.S. for deliveries or affordable transport. We already see ride-hailing drivers in cities starting to use e-motorbikes or mopeds. Furthermore, the idea of leapfrogging – using mobile tech instead of building expensive infrastructure – influences U.S. thinking about rural mobility (for example, using on-demand shuttles summoned by app instead of fixed bus routes). International success stories with mobile payment integration, bike-sharing, etc. encourage U.S. adoption.
- Global supply chains and geopolitics: The late 2020s are shaped by the global flow of materials. The EV boom depends on lithium, nickel, etc. – much comes from or is processed in China, Congo, etc. The U.S. is trying to secure its own battery supply chain (with new mines, recycling plants, and alliances with countries like Australia for lithium). Trade policies or conflicts could impact

vehicle prices or availability. For instance, if tariffs are placed on Chinese EV batteries, that could raise costs short-term. Conversely, international cooperation (like the USMCA trade agreement incentivizing North American-made EVs) could strengthen regional manufacturing. Oil prices globally will also play a role: a scenario of sustained high oil prices (due to OPEC decisions or war) would push Americans faster toward EVs and transit; a scenario of low prices might slow the EV uptake among the unconvinced. This is the kind of uncertainty RAND highlighted in their 2030 scenarios – high oil price future led to more transit and alt-fuels, low price led to sprawl and driving (rand.orgrand.org). In the near term, we have a mix: generally rising fuel efficiency standards keep gasoline demand flat even if prices oscillate.

In summary, the **2025–2030 horizon** is about setting the stage: accelerating adoption of EVs, testing autonomous systems, rebuilding infrastructure, and nudging cultural norms. We'll likely still recognize the American transport system in 2030 – highways, personal cars, airplanes dominating long trips – but the *seeds of transformation* are being planted everywhere. The learnings and groundwork from this period will determine how bold the 2030s can be in truly revolutionizing mobility.

Mid-Term Strategic Horizon (2030–2035)

By the early-to-mid 2030s, some of the **strategic shifts** in mobility will become apparent. This period represents a tipping point where earlier innovations either scale up or stall out. Assuming technology and policy progress steadily in the late 2020s, by 2035 the U.S. could see **major transformations** taking hold: a majority of new vehicles sold are electric or autonomous-capable, shared autonomous fleets roam city streets, and the first new high-speed travel routes (rail or hyperloop) might be operational. Human behaviors will also adapt – for example, a generation that grew up with Uber and e-bikes will be in their prime adult years, reshaping market demand. However, this horizon also depends on navigating constraints (regulatory hurdles, infrastructure capacity, public acceptance) that may determine whether 2035 looks radically different or just incrementally changed from 2025. Below, we outline the expected status around 10 years out:

Personal Transport & Vehicles (2030–2035)

- EVs becoming the norm: By 2035, the **internal combustion engine (ICE)** in new cars will be an endangered species. Many forecasts suggest the **majority of new U.S. passenger vehicles sold by the early 2030s will be electric**. For instance, consultancy PwC projects ~60% of U.S. light-duty vehicle sales could be EVs by 2040 (reuters.com), and interim ~50% by 2030 if aggressive policies hold (economics.td.com). Automakers like GM have pledged all-electric lineups by 2035. So by this time, **nearly every automaker's showroom is dominated by EV models**, from pickup trucks to sports cars, often the 2nd or 3rd generation of each model with improved range (300+ miles standard) and very fast charging (able to add ~200 miles in 10 minutes, thanks to 350+ kW chargers and better batteries). The total EV fleet on U.S. roads might be on the order of 50–70 million vehicles (depending on 2020s sales trajectory). **Gasoline vehicle sales**, while not zero yet, are mostly limited to heavy-duty or niche uses, or to buyers in areas with less charging (some rural regions). Meanwhile, used car markets are full of affordable EVs, which helps lower-income households go electric too. By 2035, **oil consumption for transportation will have noticeably declined** in the U.S., decoupling some from GDP growth (rand.orgrand.org) in a scenario where policy remains pro-EV. This has broader economic and geopolitical implications (e.g., gas stations begin consolidating or converting to charging hubs, and oil producers pivot business models).

- Managing the EV energy impact: The mid-2030s will test how well the power grid can handle widespread electrification. By 2040, EV charging could draw 468 TWh/year in the U.S. (≈10% of current consumption) (reuters.com), so by 2035 perhaps half that. Utilities will be employing **smart grid technologies at scale**: time-of-use pricing, vehicle-to-grid (V2G) services (where parked EVs can discharge some power back to grid at peak times), and massive deployment of energy storage to buffer renewable generation. If managed well, EVs can actually help stabilize the grid by soaking up excess solar at midday and feeding it back in evenings (reuters.com). There's a big *opportunity* here: by 2035, millions of EVs with bi-directional charging could act as a distributed energy resource – as California's energy commission noted, *EVs collectively offer more grid benefit potential than any other distributed resource* (reuters.com). However, if mismanaged, **local distribution grids** could face overload (e.g., neighborhoods where every house has two EVs fast-charging after work). Thus, expect infrastructure upgrades (new transformers, more neighborhood chargers to spread load) to be a priority in early 2030s. Also, the electricity mix will be much greener by then – ideally lots of solar, wind, maybe even advanced nuclear – making EVs truly low-carbon.

- Autonomous vehicle proliferation: The early 2030s are when autonomous driving could *truly go mainstream*. Under optimistic scenarios, **Level 4 self-driving vehicles** (that can

handle most driving without human input in certain conditions) will be widely available by 2035. McKinsey's base case had 37% of new cars in 2035 with "advanced AD technologies" (L3+ capable) (mckinsey.com), and their accelerated scenario had 57% by 2035 (mckinsey.com). By 2035, it's plausible that **highway autopilot** is a common feature – you can buy a car that will drive itself on the interstate from on-ramp to off-ramp while you watch a movie or do work. Several luxury brands already plan L3 highway autonomy in the mid-2020s; by 2035 it will trickle down to mass-market cars. More dramatically, **fully driverless robotaxi services** should be operational in many urban areas. Companies like Waymo and Cruise, if they overcome regulatory and technical challenges, will expand to dozens of cities by the 2030s. We could see **tens of thousands of autonomous taxis** in operation, offering cheaper rides due to no driver cost. The **market penetration** of AVs in the fleet might still be moderate (because cars last ~12+ years; even if 50% of new sales are AV by 2035, it might be ~20–30% of all cars on the road that have high automation). But certain cities or corridors will have a much higher concentration, creating visible changes: e.g., some downtowns might dedicate pickup/drop-off zones for AVs and remove curb parking, traffic flow might improve with connected cruise control reducing stop-and-go. A key inflection will be **insurance and liability** frameworks catching up – possibly by this time, a legal regime exists where manufacturers or operators take on accident liability from drivers when the vehicle is in autonomous mode (this will have evolved after seeing AV safety proven over billions of miles). Public acceptance should also grow once people experience the convenience and safety record – by 2030s **70%+ of people are willing to ride in autonomous shuttles or taxis** according to surveys (mckinsey.com), so adoption could accelerate quickly once availability is there.

- Rethinking car ownership and use: As EVs and AVs spread, the fundamental **business model of car ownership may shift** in the 2030s. If robotaxis become cheap and ubiquitous in cities, many residents may choose to ditch owning a personal car altogether (to save money on insurance, parking, etc.) and rely on on-demand autonomous vehicles for most trips. A study by Allianz projected that by 2040 *most city dwellers in developed countries will no longer own private cars* (allianz-partners.com, allianz-partners.com), instead using driverless electric taxis available within minutes at bus-like fares. By 2035 we may see the beginnings of this in progressive cities: car ownership rates dropping, younger folks foregoing buying a first car. **Mobility-as-a-Service (MaaS)** could flourish – subscription packages where one fee covers a certain number of AV ride miles, transit trips, scooter uses, etc. Automakers may pivot to become mobility providers (some already started, e.g., GM's Maven car-share or Ford's Spin scooters). For those who do own cars, the experience and utility of a "car" is different: it's electric (maybe acts as a power source for your home), it's highly automated (like having a chauffeur available),

and it's deeply connected (software updates, feature unlocks via subscription). One interesting possibility: **long-distance autonomous travel** – by mid-2030s, an autonomous car could drive you overnight from one city to another while you sleep in a comfy seat. Allianz's scenario even imagines self-driving long-distance pods with sleeping facilities, swapping with local autonomous taxis at city edges (allianz-partners.com, allianz-partners.com). While that might be a bit fantastical for 2035, pilot programs for "autonomous sleeper bus" services or similar could exist.

- Micromobility and modal balance: The 2030–2035 period might see a plateau or stabilization in micromobility growth. By then, e-bikes and scooters are a mature part of the transport ecosystem. **Cities will have greatly improved bike networks** (perhaps achieving the kind of safety and usage seen in some European cities). For example, Paris aims to be fully cyclable, and even Los Angeles has a "Green New Deal" goal to have 50% of trips by walking/biking/transit by 2035. If such ambitions hold, the 2030s will witness **much higher bike/ped mode share in U.S. cities**. However, micromobility's role could evolve – with AVs reducing the hassle of car travel, some might opt for robo-taxi over e-scooter. Conversely, congestion pricing and car-free zones could make micro modes even more appealing. **Shared micromobility** schemes by 2035 likely integrate with transit apps and may even be partly funded as public transport extensions. We might also see new forms like enclosed electric micro-cars (NEVs) or autonomous micro-shuttles for 1–2 people filling niches between car and bike.

- Urban congestion and traffic: With more automation, electrification, and shared modes, one might expect traffic congestion to ease by 2035. This could be true in some scenarios: **networked AVs optimizing flow could eliminate human-caused jams**, and road pricing policies reduce excessive car use. In a tech-utopian case, cities have no more on-street parking and dynamically manage traffic, so jams are rare (allianz-partners.com, allianz-partners.com). However, a counter-scenario is that AVs, being so convenient, **increase VMT** (people send their car to run errands or circle empty instead of paying parking, etc.). Planners will be actively managing this possibility – e.g., regulations might prohibit zero-occupancy cruising, and land use changes (more local living, less sprawl) could contain demand. By 2035, we'll have data from the first wave of AV deployments to see their net impact on congestion. Ideally, the **"robotaxi revolution"** will mean fewer cars can serve the same travel demand (since one vehicle can serve multiple users sequentially), thereby reducing the total vehicle count and congestion. Some analysts envision a positive outcome where **traffic fatalities plummet** due to AVs (Allianz foresaw near-zero road deaths by 2040 in developed countries (allianz-partners.com, allianz-partners.com)) – by 2035 we should see marked safety improvements if ADAS and connectivity have saturated the fleet. Lower accidents can also reduce non-recurring congestion from crashes.

- Vehicle design innovation: With new paradigms, vehicles in 2035 might look quite different. EVs free designers from traditional engine layouts; AVs free them from needing steering wheels (in fully driverless models). We might see **fully reimagined vehicle forms**: pods that prioritize comfort or entertainment, modular vehicles that can link together platoon-style on highways, or ultra-light electric vehicles for urban use. Concepts like **"social pods"** or mobile offices could be emerging. Also, many vehicles will be tailored for **sharing** – easier to clean, durable interiors, maybe standardized docking for charging. High-end cars might emphasize luxury "living room on wheels" experiences since one can relax or work while the car drives. Automakers will by now be more like tech companies, issuing software updates that can significantly change a car's capabilities over its life (perhaps upgrading a L3 car to L4 via software if sensors allow). **AI assistants** in cars could become commonplace, interacting with passengers and coordinating multi-step journeys ("After this drive, I've booked you an e-scooter for the last mile"). Overall, personal mobility by 2035 is a blend of **physical innovation and digital integration**.

Transit & Shared Mobility (2030–2035)

- Public transit renaissance (or reckoning): The 2030s could go one of two ways for public transit. In a **positive scenario**, enhanced by climate urgency and urbanization, the U.S. sees a **transit renaissance**: major investments yield new subway or light rail lines coming online around 2030–2035 (many transit projects take ~10 years from planning to operation). Cities like Los Angeles, Seattle, and Honolulu have big rail expansions underway due by the early 2030s. These will provide improved service and attract riders. Additionally, **bus systems** will have reinvented themselves with electric fleets, bus rapid transit (BRT) routes, and tech integration (on-demand shuttles and microtransit feeding main lines). By 2035, **transit in many cities could be fully zero-emission** (electric or hydrogen buses and electrified rail) and far more user-friendly, with ubiquitous real-time information and payment via smartphone or even face recognition. Ridership could climb if policies discourage driving – perhaps reaching new highs in cities that implement strong car disincentives. We might also see **free transit fare** programs expanded; some cities (like Kansas City, already fare-free buses) and even countries (Luxembourg) have tried zero-fare transit to boost usage. If funded, that could be a strategy in the 2030s to compete with free/cheap robotaxis.

- However, a **pessimistic scenario** is also possible: if autonomous cars and private services dramatically undercut transit convenience, and if governments fail to invest, public transit could stagnate or even decline in some places by 2035. For example, affluent riders might

abandon transit for robo-taxis, leaving transit with lower fare revenue and political support. This would particularly threaten marginal routes or systems in smaller cities. The outcome will likely vary by region – dense, congested megacities (NYC, SF, Chicago) will always need high-capacity transit, whereas sprawling metros might lean more on flexible mobility options. **The challenge for transit agencies is to adapt** – many are already repositioning as "mobility agencies" that orchestrate all modes, not just operate buses/trains. By 2035, one can imagine transit apps that also summon AV shuttles or rent e-bikes, effectively making transit the backbone with tentacles of other modes.

- National high-speed rail or intercity options: The early 2030s will show whether the U.S. can finally deliver high-speed intercity transport beyond flying and driving. The best hope is **California's High-Speed Rail** project: by 2030 it aims to have the Central Valley segment operational, and by late 2030s possibly connect to Los Angeles (if funding and politics allow). If by 2035 California has a functioning high-speed train between, say, Bakersfield and San Jose (and under construction to LA), it could spur public demand for more such projects. The Northeast Corridor (Boston–NY–DC) is incrementally upgrading: by 2035 there may be sections of 160–186 mph rail and travel times cut somewhat, though not a brand-new line. In Texas and Florida, private-led high-speed rail initiatives (Texas Central, Brightline) might be running: Brightline (Florida) already links Miami and Orlando (125 mph) by 2023, and could extend to Tampa; Texas Central (if it proceeds) might have a Dallas–Houston bullet train in the 2030s. **If these succeed, Americans will finally experience modern train travel domestically**, potentially shifting mindsets. It's plausible that by 2035, at least one more corridor (perhaps Pacific Northwest or Chicago hub network) gets green-lit due to the influence of these examples and international success. Remember, globally by 2030 China, Europe, Japan will be even further ahead – China's high-speed rail could approach 50,000 km, and even countries like India will have their first high-speed lines (Mumbai–Ahmedabad under construction). The *global competition and climate pressures* might push the U.S. to not be left with airlines as the only option. In absence of HSR, **inter-city bus** travel (cheap and now often electric or biodiesel-fueled) might fill some gaps, and **short-haul flights** might gradually lose share if rail or hyperloop emerges or if outlawed (as France did for certain routes (mckinsey.com,) which might influence other countries).

- MaaS **and integration at scale:** By 2035, the concept of **"mobility as a service"** should be fully realized in many places. A user could open one city mobility app and see all possible ways to get from A to B: an AI might plan a trip that combines an autonomous shuttle to a train station, a 15-minute train ride, then an e-scooter for the last mile – all booked and paid in one transaction. Such integration is being piloted now (e.g., Helsinki's Whim app, Berlin's Jelbi (mckinsey.com)). In 10 years, it could be widespread. This makes using multiple modes far easier, eroding the convenience

advantage of private cars. Also, payment systems will be more equitable – maybe fare capping (where you never pay more than a certain daily/monthly amount no matter how many trips) to encourage habitual use. **Real-time coordination** might also improve – for example, if your train is arriving, a connecting AV shuttle might be signaled to wait for passengers. Cities like Singapore and Vienna are models of integrated mobility that U.S. metros will be emulating. On the flip side, big tech firms (Google, Apple, etc.) could step in to dominate MaaS platforms, which raises questions about data privacy and fair access. By 2035, policies may be in place to ensure that mobility data is shared for public benefit (to plan services or prevent monopoly control of mobility markets).

- Autonomous public transport: Ten years out, autonomy might revolutionize transit operations. **Driverless metros** are already common globally (Paris, Vancouver have them), and by 2035 some U.S. cities might automate certain transit lines (especially new ones built with automation in mind). **Autonomous buses** will likely run on select routes; for example, dedicated-lane BRT systems could use self-driving buses to maintain tight schedules and reduce labor costs. In less-structured environments, smaller AV shuttles will connect neighborhoods to trunk lines. A significant development would be if unions and transit agencies reach agreements to redeploy bus drivers as fleet monitors or customer service rather than physically driving, to allow scaling up service without linear labor cost increases. If transit can reduce costs via autonomy, it could afford to run more frequent service including late at night, making it more attractive to riders and potentially breaking the vicious cycle of declining ridership -> budget cuts. Safety is another plus: by 2035, autonomous tech should dramatically reduce transit-related accidents (like buses hitting pedestrians), reinforcing transit's safety advantage.

- Electrified, smart infrastructure: By this time, infrastructure itself will assist mobility. **Smart traffic signals** citywide will dynamically adjust to minimize overall delay, often prioritizing high-occupancy vehicles and transit. **Vehicle-to-infrastructure (V2I)** communication may be commonplace: cars and buses ping an intersection as they approach, and if a bus is behind schedule, the light stays green longer to keep it moving. Some cities might implement **platoon lanes** for connected vehicles – allowing AVs to closely follow each other at speed to increase highway throughput. On transit corridors, things like **wireless charging** pads could be embedded at bus stops or along routes to charge e-buses or even personal EVs as they drive (this is being tested now in some roads). **Digital twins** of city transport networks (virtual real-time replicas) might be used by city planners to run simulations and respond to events (accidents, special event traffic) proactively. All these incremental improvements contribute to a smoother, more efficient system where different modes complement rather than conflict.

- Rural and suburban mobility: By 2035, the hope is that even outside big cities, residents have better options than just driving. **On-demand transit** in low-density areas could be widespread – using autonomous vans by then. For instance, a suburban county might have an AI-dispatched shuttle system that people can summon with an app, replacing fixed bus routes. This is more feasible once vehicles drive themselves (cost goes down). Also, **car-sharing** may expand beyond cities; one could access a shared autonomous car in a suburb to go to the grocery store and back, eliminating need to own a second car. Drones might play a role in rural mobility too (e.g., delivering medicine to remote homes). The federal government might fund these services as a matter of equity, ensuring that the mobility revolution isn't limited to cities. If successful, by 2035 even those in small towns have at least a few mobility choices (though likely not the rich menu urban dwellers have).

- Transit-oriented development (TOD): Recognizing that land use and mobility are intertwined, the 2030s should see growth in **transit-oriented development**. Many cities and suburbs will upzone areas around rail stations or major bus corridors to allow mixed-use, higher-density communities where people can live, work, and play with less need to drive. This concept is already popular but was sometimes resisted; with climate goals and a new generation in leadership by 2035, we might see wider adoption of TOD zoning and even **"car-free" neighborhoods** (development projects that explicitly limit or exclude parking and design for walking/biking/transit from the start). International inspiration for this includes places like Vauban in Germany or various European city centers that removed cars. In the U.S., perhaps some new communities (especially those rebuilding after climate disasters) will choose to rebuild with a transit- and pedestrian-centric layout.

Freight & Logistics (2030–2035)

- Autonomous trucking at scale: By the mid-2030s, autonomous trucks could be a common sight on highways. McKinsey projects that in the U.S., autonomous heavy-duty trucks might comprise ~13% of the trucking fleet by 2035 (mckinsey.com, mckinsey.com), the highest adoption rate among major regions. This implies that on long Interstate stretches, especially in the south central and western U.S., convoys of self-driving trucks will be routinely moving freight. Likely, these trucks operate mostly on highway "hub-to-hub" routes; at designated transfer hubs near interchanges, loads are swapped to human-driven vehicles for the local streets portion. The efficiency gains (trucks can run nearly 24/7 with minimal stops) and fuel savings from smoother AV driving are substantial. The total cost of ownership for autonomous trucks is expected to dip below human-driven trucks by around 2033 for long haul routes (mckinsey.com, mckinsey.com), making them

economically irresistible for trucking companies. By 2035, the U.S. trucking industry (a ~$700B industry) will be deeply transformed – potentially with new players (tech companies operating fleets) and labor shifts (fewer long-haul drivers, more local and tech maintenance jobs). There will be safety and public perception milestones: if autonomous trucks achieve millions of miles with lower accident rates than humans, they will gain broad acceptance. But any major accidents early on could prompt public backlash or regulatory freezes (mckinsey.com, mckinsey.com). Assuming success, regulators will have established comprehensive rules for AV trucks by then (covering cyber security, mandatory sensors, maybe dedicated AV lanes in some corridors).

- Logistics efficiency and consolidation: With advanced connectivity by 2035, freight logistics becomes highly optimized. Platooning of trucks (even with a human lead truck and following autonomous ones) might be widespread before full autonomy takes over. Distribution routes are dynamically planned by AI for just-in-time delivery. Warehouses are almost fully automated: by this time robots handle most picking and palletizing, and "dark warehouses" (lights-out facilities with no human workers inside regularly) could be common for large retailers. 3D printing and local manufacturing might reduce some need for long-distance shipping of certain goods, while drones and autonomous delivery bots handle the "last 100 feet" to customers' doors. Same-day or next-hour delivery could become the expectation for most products, which requires extremely efficient local logistics networks.

- Electric and hydrogen in freight: Alongside automation, freight is decarbonizing. By 2035, a significant share of commercial trucks are zero-emission. Likely, medium-duty delivery trucks and vans will be mostly electric (Amazon, UPS etc. all EV). For heavy-duty long-haul, battery advancements (solid-state batteries by late 2020s) may allow some big rigs to be battery-electric with 500+ mile range and megawatt charging. In parallel, hydrogen fuel-cell trucks might carve out a niche, especially for routes requiring quick refueling and very long range (1000+ miles). Companies like Toyota and Nikola are working on fuel-cell semi-trucks; California is investing in hydrogen stations for trucks. By 2035, we could see hydrogen semi fleets operating on West Coast corridors. Globally, Europe and China also push trucking toward hydrogen for long haul. If hydrogen economy scales (for trucking, industry, etc.), the U.S. might follow suit. Alternatively, if battery tech exceeds expectations, electric semis with frequent charging stops could prevail. Either way, the diesel engine's dominance in freight will be waning by the 2030s. This means cleaner air around ports and highways, but also new infrastructure needs (charging plazas for trucks, hydrogen fueling depots). We should note the rail freight sector too: in the U.S., freight trains might adopt battery or hydrogen locomotives by then (prototypes exist), further cutting diesel use.

- Global supply chain reconfiguration: The geopolitical and climate realities of the 2020s likely force a reconfiguration of global supply chains by the 2030s. Companies are diversifying sources (some manufacturing moving out of China to other countries or back to North America – "reshoring"). This could slightly reduce long shipping distances and increase regional freight flows. Ports will still be busy, but perhaps more traffic is cross-border by land (Mexico–USA rail/truck) as manufacturing grows in Mexico, for instance. A more distributed supply chain could also be more resilient to single-point failures. Technology helps here too: advanced analytics predict disruptions (weather, political) and reroute goods proactively. By 2035, we might see smart ports where AI schedules every container movement and autonomous cranes and trucks hustle containers efficiently (some ports like Rotterdam are already highly automated). Blockchain or similar tech might provide end-to-end tracking of goods, improving transparency and efficiency in customs and handling.

- Hyperloop freight and high-speed logistics: If hyperloop technology proves out in the late 2020s, by the mid-2030s we might actually have a hyperloop freight corridor in operation or nearing completion. A possible early use-case is moving air cargo or fast delivery packages between airports or distribution centers at near-supersonic speeds. For example, one could imagine a hyperloop connecting the Port of Los Angeles to an inland logistics hub, slashing a 1-hour truck trip to a 10-minute tube trip, moving containers rapidly off the congested port area. Virgin Hyperloop had pivoted to cargo, implying initial commercial deployments might focus there. Another concept: Europe's efforts (e.g., Hardt Hyperloop in Netherlands) are looking at freight as well. If one of these is running by 2035 internationally, the U.S. could fast-follow. Also, high-speed rail for freight: currently rare (most high-speed trains carry passengers only, except some parcel services in Europe/China). By 2035, if high-speed rail lines exist in U.S., they might carry high-value freight at night. Even drones at scale could form part of freight: large cargo drones (VTOL or fixed-wing) might handle regional deliveries for urgent goods (medicine, electronics). Companies like Zipline and Boeing are working on bigger drones that by then could autonomously carry, say, 500 lb payloads over a few hundred miles – essentially unmanned small planes.

- Labor and workforce: Automation will displace certain jobs (truck drivers, warehouse pickers) but also create new ones (drone operators, fleet technicians, logistics analysts). By 2035, we might see a partial resolution of the truck driver shortage because many remaining roles are more local (and hopefully more attractive), while long tedious highway stretches are automated. Truck drivers might transition to remote monitors (overseeing multiple autonomous trucks remotely, ready to take tele-operation control in tricky situations) – a job that could even be done from an office. This could open opportunities for a more diverse workforce (e.g., people who cannot do long-haul away

from home could still manage trucks remotely, including more women entering what was a male-dominated field). Unions and industry will have had to negotiate this shift – perhaps resulting in guaranteed training programs to move drivers into these new roles. The mid-2030s will be a balancing act of maximizing efficiency and taking care of the human workforce so that society accepts these changes without too much disruption.

- Amazon-effect maximal: By 2035, the expectation of rapid delivery for everything will be firmly ingrained. Instant logistics might even extend to construction or manufacturing (on-demand supply delivery exactly when needed). The distinction between retail and logistics blurs – stores become showrooms or small warehouses for immediate fulfillment, integrated with logistics networks. The transportation network will be increasingly driven by logistics optimization rather than commuter patterns as e-commerce share of retail could be 30-40% or more by then. This will have urban planning implications: perhaps dedicated lanes or times of day for freight vs passenger travel to avoid conflict. We may also see underground delivery tunnels in some cities (Elon Musk's Boring Company initially aimed for transit but could pivot to freight tunneling for small packages). The idea is not far-fetched – in the 1800s some cities had pneumatic tube mail delivery; by 2030s, maybe automated underground systems handle a chunk of deliveries in dense urban cores, reducing truck congestion.

Aviation & Long-Distance Travel (2030–2035)

- Greener aviation moves mainstream: By 2035, the aviation industry will be in the midst of a major energy transition. Under international agreements (like ICAO's CORSIA) and pressure to meet climate goals, airlines aim for net-zero emissions by 2050. In 2030–35, one can expect Sustainable Aviation Fuel (SAF) to account for a notable share of jet fuel use – perhaps 10–20% globally. The U.S. likely has incentivized SAF production (via the Inflation Reduction Act and other policies) leading to large biofuel refineries using feedstocks like agricultural waste, or synthetic electro-fuels using captured CO2. We'll see more flights branding themselves as "partially powered by SAF". Additionally, the first hydrogen-powered aircraft could take flight by the mid-2030s.
- Greener aviation moves mainstream: By 2035, the aviation industry will be deep into its energy transition. Under pressure to cut carbon, airlines are scaling up Sustainable Aviation Fuels (SAF) and exploring new aircraft technologies. SAF – made from biofuels or synthesized from captured CO_2 – could account for a significant share of jet fuel by the 2030s. Governments and industry initiatives aim to make SAF 10% or more of fuel consumption by 2030, and even higher by 2035, helping to reduce aviation's net emissions. Additionally, the first hydrogen-powered demonstration aircraft are expected

by the early 2030s (Airbus is eyeing a 2035 entry for a hydrogen airliner). By 2035, we might see small hydrogen fuel-cell commuter planes flying regional routes, and serious testing of hydrogen or hybrid-electric propulsion on short-haul aircraft. Electric aviation will also advance: the late 2020s prototypes (like 9-seat electric planes) could scale up to 30-50 seaters by the mid-2030s as battery energy density improves. These will handle short flights (perhaps under 300 miles) with zero emissions. All major aviation players will be investing in these areas, often collaboratively (e.g., U.S. and European firms partnering on battery or hydrogen standards).

- Urban air mobility matures: A decade into deployment, eVTOL air taxi networks could be a routine (if still premium) transport option in many cities by 2035. After initial launches in the late 2020s, companies would refine operations, improve vehicle range (maybe from ~20-mile hops to 50+ miles per charge), and reduce noise. By this time, dozens of metropolitan areas globally – including a few in the U.S. – operate aerial ridesharing services. For example, one could imagine in 2035 booking an Uber Air (or similar) in Los Angeles to fly from downtown to LAX or from Silicon Valley to San Francisco. Prices are still relatively high, but perhaps closer to an expensive ground taxi than to chartering a helicopter, due to economies of scale and autonomy (eventually these eVTOLs may fly without pilots, further cutting cost). Safety regulation will have evolved after accumulating a strong flight record in the early 2030s. Vertiports (rooftop or barge-based landing pads) will be integrated into transit centers and skyscrapers. This mode won't carry a huge share of travelers, but it adds a new layer to urban mobility for time-sensitive trips. It may also provide critical services like emergency response (ambulance drones).

- Supersonic and high-speed travel: The 2030s might also mark the return of supersonic passenger travel. Several startups (Boom Supersonic, Aerion) and national projects are developing supersonic jets that run on 100% SAF. Boom's 65-passenger Overture jet is slated for 2029; if it succeeds, by 2035 there could be limited supersonic routes (e.g. transatlantic flights in ~3.5 hours (weforum.org)). These would target business travelers willing to pay a premium, and airlines might operate them on select high-demand city pairs. Concurrently, research into hypersonic point-to-point travel (e.g., SpaceX's concept of suborbital rocket flights from one city to another) continues. By 2035 this is unlikely to be commercial, but there may have been military or experimental test flights – keeping the idea alive for beyond 2040. On the ground, hyperloop could finally make its debut if international projects stay on track. It's conceivable that by the mid-2030s, a short-distance hyperloop line (maybe 50-100 km) is open to either cargo or even passengers in a country like the UAE or somewhere in Europe. This would be a proof of concept for the U.S. to observe. If the tech and safety are proven, the U.S. might greenlight its first hyperloop route construction in the late 2030s (for example, a Texas

triangle or Midwest corridor). In essence, by 2035 travelers might have three new ultra-fast modes in pilot stage: supersonic jets, hyperloop pods, and maybe very high-speed rail in one or two corridors – all alternatives to conventional planes and cars.

- Space tourism and exploration: The early 2030s will likely see the first private space stations and a broader space tourism menu. NASA plans to retire the ISS by 2030 and transition to commercially owned stations (such as those by Axiom Space). By 2035, wealthy tourists may be taking week-long trips to an orbital hotel (essentially a converted space station module) – at a steep price, but far more routine than the one-off orbital trips of the 2020s. The space tourism market by 2035 is still relatively small, projected around $4–6 billion (weforum.org), but it's no longer sci-fi: possibly several hundred people will have gone to space as paying customers by then. This includes suborbital hops (with companies like Blue Origin running regular launches) and orbital excursions. The impact on broader mobility is indirect: success in space tech could accelerate materials science and autonomous systems that trickle down to aviation and transit. Also, a cultural shift – seeing Earth from space might spur even greater environmental consciousness (the "overview effect"), influencing public support for sustainable mobility on the ground. By the mid-2030s, talk of point-to-point suborbital travel (rocket flights from, say, New York to Shanghai in an hour) will either be moving forward with prototypes or shelved as impractical. If moving forward, maybe a demonstration route (uncrewed) will have been done by SpaceX or a successor, hinting at a revolutionary 2040s possibility.

- Infrastructure and airports: Airports in 2030–35 will transform into multimodal hubs. Many major U.S. airports will be connected to downtowns by fast rail or automated vehicles (e.g., Los Angeles' LAX train, Chicago O'Hare express). Some airports might add vertiports for air taxis to dock. Inside, processes are streamlined: biometric check-in and security means curb-to-gate is faster. Baggage handling could be robotic. Drone surveillance and AI handle a lot of airfield inspection and security tasks. To handle more flights (as air travel demand grows 60% by 2040 (thinkwithgoogle.com)), airports use digital twins and AI scheduling for gates and runways, squeezing out efficiency. The concept of an "airport city" might grow – airports housing solar farms to produce energy, logistical centers with hyperloop or high-speed rail links emanating from them (for instance, an airport could double as a regional passenger rail hub by 2035, following the intermodal models of Europe/Asia).

- Climate impacts on travel: By the 2030s, climate change will be an increasingly dominant factor in long-distance travel. People and governments may start to impose carbon costs or limits on frequent flying. For example, more countries could adopt measures like France's ban on short flights with rail alternative (mckinsey.com), or even implement "frequent flyer levies" (progressively higher tax on each additional flight per year). In a

scenario where climate action intensifies, by 2035 many travelers in the U.S. might opt for trains or coaches for trips under 500 miles, aided by guilt or regulation. On the other hand, if tech like SAF and electric planes succeed, aviation might maintain social license by claiming green credentials. The mid-2030s will reveal whether we are curbing demand for air travel or fully transitioning it to sustainable energy. Additionally, climate change might physically disrupt travel more – severe weather could force more flight cancellations or road/rail outages, prompting infrastructure upgrades (e.g., higher roadbeds, cooling systems for rails in extreme heat, etc.). The planning in this period is increasingly about resilience: ensuring mobility networks can withstand fires, floods, storms which by 2030s are unfortunately more frequent.

In summary, the **2030–2035 strategic horizon** is when many trends reach critical mass. Electric and autonomous vehicles move from pilot phase to prevailing norm. Public transit either reinvents and revives itself with new technology and integrations or struggles to compete in an AV world. Freight transport becomes smarter and cleaner, with human drivers playing a reduced role in long-hauls. New modes like eVTOLs, hyperloop, and supersonic jets, if successful, add layers to the transport system. Culturally, the 2030s could cement a shift away from the 20th-century car-centric mindset to an ecosystem of varied, service-oriented mobility options. **Global influence is strong** – nations learn from each other's successes (and failures), whether that's Scandinavia's bicycle dominance, East Asia's bullet trains, or China's tech-enabled traffic management. By 2035, the U.S. may either be on track to lead the new mobility era or be playing catch-up, depending on choices made in the 2020s. This period sets the stage for the truly transformational changes imagined for 2040 and beyond.

Long-Term Transformational Horizon (2045)

Looking twenty years out to around 2045, we enter a highly **speculative, transformational horizon**. If current trends hold and accelerate, the mobility landscape two decades from now could be almost unrecognizable compared to today's. This is the realm of ambitious scenarios: cities with **no private cars**, cross-country trips via **tube in minutes**, autonomous vehicles so ubiquitous that "driving" oneself is rare, and a fully decarbonized transport sector. It's also possible that progress is slower on some fronts, and the reality in 2045 mixes advanced tech with legacy systems. Here we explore plausible developments by 2045, acknowledging uncertainties:

Personal Mobility and Vehicles in 2045: Private car ownership may well **peak in the 2020s** and decline by 2045, at least in urban/suburban contexts. By the mid-2040s, most city dwellers in developed regions **will not own personal cars**, according to one forward-looking analysis(allianz-partners.com). The role of the automobile is likely to shift to a service. fleets of **electric, autonomous robo-taxis** handle the majority of local trips in metro areas, accessible on-demand at low cost. In such a future, the convenience and price of a shared AV ride (possibly **arriving within 2 minutes and costing about the same as a bus fare (*allianz-partners.com)) render car ownership more hassle than it's worth. The number of cars per capita thus drops significantly. Where there were 2+ vehicles per household in the 2010s, in 2045 perhaps a typical household (if they even bother owning a car) has zero or one, supplemented heavily by shared mobility.

All new vehicles by the 2040s are **zero-emission** – either battery-electric or hydrogen fuel cell – as combustion engine new sales have been phased out in many markets (Europe's ban on new ICE cars by 2035, likely matched or followed by the U.S.). By 2045, even the used fleet of gas cars is largely retired. The air quality in cities improves markedly as a result. **Noise pollution** also drops with electric drivetrains; the loudest street noises might come from tire friction or the whir of electric bus motors.

Autonomous driving technology in 2045 is expected to be **mature and ubiquitous**. Vehicles at SAE Level 5 autonomy (full self-driving in all conditions) are commercially available and common. Human driving is not outlawed (especially in rural areas or for vintage car enthusiasts), but in many busy zones it is restricted for safety. It's possible that by this time, **human drivers are geofenced out of many city centers**, or at least human-driven vehicles must operate in a special mode (communicating with city AI systems for coordination). Road safety by 2045 should reach unprecedented levels: with connected, intelligent vehicles reacting faster than humans, traffic collisions and deaths could approach near-zero in developed countries (allianz-partners.com). This fulfills the "Vision Zero" ambitions – essentially the concept of widespread road fatalities might become a thing of the past, much like diseases that have been eradicated. Any accidents that do occur are likely minor (e.g., low-speed scuffs, or incidents involving bicycles/scooters which are harder to fully automate (allianz-partners.com).

The *experience* of personal travel in 2045 could be radically different. Commuting in a driverless car, people will treat the vehicle as a living room or office: you might hold meetings or sleep while your AI chauffeur navigates. In Allianz's future vision, inside your driverless vehicle **"passengers will be able to use journey time to work, play, socialise… or even indulge in virtual reality travel" (allianz-partners.com). Cars essentially become another space for digital life or relaxation, blurring the line between traveling and not. Some autonomous vehicles might not even look like today's cars – they could be **modular pods** that join into platoons on highways (forming a kind of train) and split off to individual destinations. For longer trips, one might hire an autonomous **sleeper vehicle** that provides a bed and drives overnight to another city (allianz-partners.com), replacing red-eye flights or train rides. These concepts exist in embryonic form today; by 2045 they could be mainstream offerings.

City design and mobility ecosystems: Over 20 years, expect a profound reconfiguration of urban spaces to favor people over machines. Many North American cities built around the car in the 20th century will by the 2040s be deep into **retrofits to remove cars** and repurpose streets. We may see downtown freeways removed (as some cities like Seattle and San Francisco began doing decades earlier) and replaced with boulevards or parks. Parking lots and garages – less needed thanks to fewer private cars – are converted to housing, parks, or logistics hubs. Curbside parking spaces become wider sidewalks, cafe seating, or micromobility lanes. **Urban land once devoted to cars (which was a huge percentage of ground area) is reclaimed for public use* (allianz-partners.com). This is enabled by the fact that far fewer vehicles can move far more people when shared and autonomous; plus, those vehicles can be **moving nearly constantly** instead of sitting parked 95% of the time as in the past.

Cities in 2045 are likely to be **smarter and more integrated** than ever. The concept of a **"15-minute city"** – where every essential service is within 15 minutes by foot or bike – may be realized in many places (mckinsey.com). Zoning will have long since shifted to mixed-use, dense development rather than segregated sprawl. Combined with mobility services, this means daily life involves less long-distance travel for errands. When travel is needed, the default could be **active and shared modes**. Walking and cycling might account for a large portion of trips (helped by safe infrastructure and perhaps widespread use of electric assist for bikes). **Micromobility devices** in

2045 might include things we see now (e-bikes, scooters) and some new ones (like ultralight one-person EVs, or even robotic "pods" that can switch between driving you or delivering goods).

Public transit in 2045, in a transformative scenario, interweaves seamlessly with these other modes. High-capacity transit remains crucial for moving large numbers in dense corridors – many cities may have expanded metro or light rail networks by then. But these systems are augmented by **fleets of autonomous shuttles** dynamically routing passengers between transit hubs and their final destinations. **Integration is total**: a city's mobility AI might orchestrate everything from traffic signals to dispatching the right vehicle type for each trip request, across public and private operators. The notion of waiting long or having complex transfers is mitigated by predictive systems that ensure, for example, as you step off a train, an AV shuttle is already queued up for you (pooling you with others headed the same way). **Inter-city travel integrates with urban travel** too: for instance, someone traveling from a suburb of one city to a suburb of another might take a door-to-door trip involving an AV to a hyperloop station, tube to the destination region, then another AV – all booked together.

Freight and logistics in 2045: Goods movement will be highly automated end-to-end. Warehouses, trucks, trains, ships – all are run with minimal human intervention. **Autonomous trucks** likely dominate highways; by 2045 perhaps nearly all long-haul trucking in advanced economies is autonomous. Where are the truck drivers? Many will have transitioned into overseeing the systems or focusing on local delivery and specialty freight tasks. The economics of freight will favor those who automated early – it's expected that by 2035 the U.S. had ~13% of trucks autonomous (mckinsey.com), by 2045 this could be >50% or approaching 100% for main routes if no major barriers. **Physical truck stops** might evolve into automated charging/refueling depots for robots. We might even see dedicated **freight lanes or corridors** on which only autonomous vehicles operate, maximizing safety and efficiency (akin to rail but on rubber tires).

Logistics will also have undergone a **modal shift** for sustainability and efficiency. Rail might carry more share of freight (with automated trains and possibly new high-speed freight lines). If hyperloop tech proved out, by 2045 there could be **hyperloop freight networks** connecting major ports and logistics hubs, moving containers or capsules at extremely high speeds with minimal energy (maglev in vacuum). These could circumvent the capacity limits of highways and

traditional rail. A global example: Europe or China might have begun building such tube freights in the 2030s; by 2045 the U.S. could connect major distribution centers via hyperloop, dramatically cutting freight transit times coast-to-coast to a few hours. This would effectively make inventory management real-time and eliminate a lot of warehousing needs.

Urban freight in 2045 is likely dominated by **drones and delivery bots** for the last mile. The vision of "30-minute delivery" for anything might be standard. Small electric sidewalk robots or flying drones will carry packages from local micro-distribution centers to homes efficiently. In downtown areas, perhaps underground delivery tunnels or pneumatic tube systems supplement this for moving goods without adding street traffic. We can expect that **consumer expectations for immediacy and reliability** will be extremely high – requiring a near-flawless logistics choreography that only AI can manage. The positive side: consumers get what they need quickly; the challenge: the system could be quite complex and vulnerable to cyber disruption if not secured.

Air travel and beyond in 2045: Commercial aviation by 2045 should be drastically cleaner. Optimistically, short-haul flights up to ~1000 km are mostly serviced by **electric or hydrogen aircraft**. Several major manufacturers plan hydrogen airliners by 2035–2040; if they succeed, by 2045 airlines will be operating them on regional and maybe medium-range routes. This cuts emissions and noise (water vapor contrails might still need addressing but perhaps mitigated). Longer flights might use **synthetic e-fuels** or advanced SAF, meaning jet travel could reach near-zero net carbon by mid-century, aligning with global climate goals. Aircraft might also look different – designs like blended-wing bodies or distributed electric propulsion could increase efficiency and reduce noise.

However, it's possible that by 2045 the demand for traditional air travel is tempered by other options. **High-speed rail networks** (if the U.S. and others invest heavily) could replace a lot of <4 hour flight routes. Europe and China by 2040 may have further expanded high-speed rail such that flying is unnecessary for many domestic trips; the U.S. by 2045 might (in the best case) have a connected high-speed rail in parts of the country (e.g., linking the mega-regions: Northeast, California, Texas triangle, Pacific Northwest, etc.). If so, Americans might embrace train travel for convenience, and airlines would focus on longer haul and international routes. Additionally, **hyperloop** or new tube travel – if it overcame technical hurdles – could be operational for both

freight and passengers on key corridors by 2045. A hyperloop between Los Angeles and San Francisco, for instance, was once dreamt; by 2045, perhaps a traveler can zip between them in <1 hour through a tube, which would be transformative (though this assumes heroic progress and public acceptance of the new mode).

Space travel might become a niche form of ultra-long-distance mobility. If suborbital rockets for travel are proven safe and somewhat economical by the 2040s, there could be a small network of point-to-point services for urgent cargo or VIP passengers (e.g. military rapid transport, or ultra-luxury travel). For example, a New York to Tokyo trip might be 1.5 hours via a suborbital hop. This remains speculative; the environmental impact and cost may keep it impractical for widespread use. Alternatively, improved **supersonic/hypersonic airliners** (using green fuels) might fill that role more sustainably – by 2045 perhaps second-generation supersonic planes capable of transpacific routes exist, if noise over land can be solved with sonic boom mitigations.

Space tourism in 2045 could be more routine for those who can afford it. There might even be the first attempts at **"space hotels"** in orbit or on the Moon. Companies or international agencies could run lunar orbital flights or short stays on the Moon (NASA's Artemis program aims for a sustained lunar presence in the 2030s, which could open doors to civilian moon visits later on). While these are travel, they're not mass mobility – more an extension of the tourism industry for the wealthy or adventurous. The broader impact might be inspiration and technology transfer to Earth transportation systems (for instance, advances in life support and energy management in space might improve sustainable tech on planes and vehicles).

Societal context in 2045: By the 2040s, **generational turnover** will mean the decision-makers (political, economic) mostly grew up in the 21st century. The collective priorities are likely to strongly favor sustainability (given the lived experience of climate change) and technological integration. The U.S. population will be larger and older; about **22% of Americans will be 65+ in 2040* (ncoa.org) (even more by 2045), meaning accessibility is crucial. A positive scenario is that autonomous vehicles have greatly enhanced mobility for the elderly and disabled – an 80-year-old in 2045 can maintain independence thanks to ubiquitous self-driving pods and delivery services for all needs. **Rural areas** hopefully benefit too: even if population shifts (some rural decline,

some climate-driven relocation), autonomous shuttles and drones could keep people connected without needing to drive long distances.

On the other hand, climate change by 2045 might force difficult adaptations. Some regions (low-lying coastal zones, parts of the drought-hit Southwest) could see significant population outflows. We may witness an internal migration of tens of millions of Americans over decades to relatively safer regions (theatlantic.comclimatenow.com) . Infrastructure in abandoned or extreme-risk areas might be left to crumble, while receiving areas must rapidly build capacity. This could result in entirely **new cities or expansion of mid-size cities** in the North and Midwest. Those new developments can be built with 2040s technology and design from scratch – potentially **car-optional or car-free communities** built around autonomous shuttles, walking, and cycling as primary modes. Essentially, climate migration could inadvertently drive the creation of more sustainable cities if managed with foresight.

Politically, by 2045 one hopes there is a strong consensus on the need for resilient, clean mobility (as the effects of inaction would be painfully clear). However, social equity issues will be front and center: there is risk that advanced mobility (AVs, air taxis, hyperloops) could widen inequality if only accessible to the wealthy tech hubs. A critical measure of success by 2045 is whether **mobility is inclusive** – does every segment of society have affordable access to efficient transport? To ensure that, policies might have introduced, for example, **universal basic mobility credits** (vouchers or affordable subscriptions for mobility, akin to internet access seen as essential). Public agencies might still operate core infrastructure and services to avoid complete privatization of mobility. The 2040s could either see a utopia of accessible mobility-for-all, or a fractured system where the rich zip around in pods and flights while others face bus service cuts – much will depend on policy choices and governance as tech advances.

Global Interdependence in 2045: By this time, the distinctions between how different countries travel may blur if technology diffusion is wide. Innovations in one place quickly spread. For instance, **if China perfects a city-wide AI traffic control reducing jams by 90%**, pretty soon those algorithms (or Chinese tech companies) will be managing traffic in American cities too. If Europe achieves a super-efficient rail network, U.S. regions could partner or learn from their models to implement similar systems. Conversely, U.S. breakthroughs in software, AI, or aerospace could

benefit other countries. The world in 2045 will likely be highly connected (physically by travel and virtually via communication), so global standards and cooperation will matter for things like autonomous vehicle communication protocols, air traffic management (drones will need international rules to fly across borders), and climate policies (e.g., perhaps a global carbon price by then that influences all transportation decisions). **Leapfrogging developing regions** could inspire developed ones – for example, if by 2045 several African and South Asian cities largely use solar-powered electric bikes and mini-buses rather than private cars (skipping the car-centric phase of development), it might demonstrate a model of mobility that is lower-cost, healthier, and more sustainable, which even wealthier cities might emulate to solve their problems.

In sum, the 20-year horizon promises **transformational change**: a potential end of the private-combustion-car era, the rise of autonomy and AI-managed mobility systems, new high-speed travel modes, and a real chance to align mobility with climate sustainability. This future is not guaranteed – it requires navigating the next two decades wisely, with proactive policy and global collaboration. But the pieces are visible today. What was once science fiction (self-driving cars, flying taxis, space trips, 600-mph vacuum trains) is now within the realm of engineering possibility. By 2045, we will see which of those possibilities become reality, fundamentally reshaping how humans move.

Global Innovations and Interdependencies

Mobility futures will not unfold in isolation. The U.S. mobility landscape is tightly connected to global developments – through technology exchange, economic ties, and shared climate goals. It's important to highlight how **global innovations intersect with U.S. trends**:

- High-Speed Rail and Public Transit: The U.S. has lagged behind countries like China, Japan, and those in Europe in building high-speed rail. China's example – a vast network of bullet trains built in a few decades – shows what is feasible with political will and investment. By 2035, China aims to have 70,000 km of high-speed rail (mckinsey.com), connecting even secondary cities. This global availability of HSR technology (trains, signaling systems, etc.) can benefit the U.S. if projects are pursued; companies from Japan (Shinkansen) or Europe (TGV, ICE) are eager to supply know-how. The **success of high-speed rail abroad creates public pressure in the U.S.** – for instance, Brightline in

Florida imported Siemens trainsets based on European designs. Similarly, European cities have demonstrated how robust public transit and bike infrastructure improve quality of life – Copenhagen's 60% bike commute rate, Paris's aggressive bike lane rollout, London's congestion pricing – these inspire U.S. city planners. Indeed, many U.S. cities now adopt Vision Zero road safety policies imported from Sweden, bus rapid transit imported from Latin America, and so on. In the future, we might see American cities explicitly model new developments on the **"Barcelona superblock"** concept (grouping city blocks to reduce traffic inside) or the **Dutch urban design** prioritizing pedestrians and cyclists. International best practices are more readily shared via global urban networks and forums.

- Vehicle Manufacturing and Markets: The automotive industry is global. Decisions in the EU, China, or India directly affect vehicles available in the U.S. For example, the EU's mandate for all new cars to be zero-emission by 2035, and similar targets in China, mean that global automakers like VW, Toyota, and GM are retooling for EVs across their lineup (itdp.org). The result: by the 2030s, the vast majority of models on sale worldwide (including in the U.S.) will be electric, simply because manufacturers will streamline to electric to satisfy the largest markets. **Battery supply chains** are another interdependency – China currently dominates battery production, but U.S. policies are pushing domestic manufacturing. There is competition for critical minerals (lithium, cobalt) globally, but also cooperation (the U.S. forming alliances with allies for sourcing). If a breakthrough in battery chemistry occurs (say, a solid-state battery from a Japanese lab, or a sodium-ion battery from a Chinese company), it will spread globally and could dramatically accelerate EV adoption everywhere. Likewise, progress in autonomous driving is led by both U.S. firms (Waymo, Tesla) and others (Baidu in China, Mobileye in Israel); regulations and public acceptance in one country (like permissive laws in parts of China) can give head-starts that then propagate the technology. By 2045, it's conceivable that **international standards for autonomous vehicle safety** are in place, negotiated in forums akin to how aviation standards (ICAO) or telecom standards (ITU) are set. This would allow AVs made in one country to operate in another seamlessly.

- Leapfrogging Mobility in Developing World: In many emerging economies, the lack of entrenched legacy infrastructure allows **innovation from the ground up**. For instance, **African cities are pioneering mobile payment-based transit** and new models like "smart matatus" (mini-buses in Kenya tracked by apps for arrival times). Rwanda is testing autonomous drone delivery for medical supplies nationwide. **Electric two- and three-wheelers are booming in India and parts of Africa** as affordable mobility (India already has millions of e-rickshaws). These trends mean the **global south could adopt clean, shared mobility faster in some respects** – fewer cars per capita to begin with, so if cheap EV bikes arrive, personal car growth could be bypassed. This is a double-edged

sword for the U.S.: on one hand, mass production of affordable vehicles (like $3000 electric motorcycles or $10,000 micro-EVs) in Asia/Africa can create new import markets and options for low-income American consumers. On the other, if the U.S. doesn't keep up in innovating its mobility systems, it could ironically have *older* tech (traffic jams, gas cars) than some developing regions by 2040. The exchange of ideas is already evident – concepts like **"leapfrog" mobile banking in Africa inspired fintech in the West, similarly leapfrog transport solutions (e.g., ride-hailing by motorcycle taxi in Lagos) inform Western companies' offerings**. By collaborating with and learning from these environments, U.S. cities could implement simpler, cost-effective mobility solutions (for example, informal jitney services coordinated by app, which is common in parts of global south, might be used to supplement transit in U.S. suburbs).

- Climate and Policy Linkages: Climate change is a global problem requiring a global mobility response. The Paris Agreement and subsequent COP commitments drive nations to reduce transport emissions – over 150 cities worldwide are now implementing measures to curb private car use and promote sustainability (mckinsey.com) . These include everything from **fuel economy standards** to **EV purchase incentives** to **urban access restrictions**. The U.S., EU, China, and others often watch each other's policy experiments. For example, when **Norway reached over 80% EV sales** by using heavy incentives and toll exemptions, it provided a blueprint that was emulated (to a lesser extent) in states like California. When London and Stockholm succeeded with congestion pricing, New York City took note and passed its own plan. This cross-pollination will only increase. By 2045, there might even be an international carbon price or coordinated fuel tax that makes fossil fuels uniformly expensive globally – forcing all countries toward electrification. Alternatively, breakthroughs in one locale – like a city achieving zero fatalities or zero emissions – set a **benchmark for the world**. **Global forums (UN, C40 Cities, etc.) and agreements** will continue to shape U.S. mobility indirectly by shaping the priorities (e.g., zero-emission vehicle pledges). Conversely, if the U.S. develops, say, advanced AI traffic management that cuts emissions and delays significantly, it would likely be exported as a climate solution to other congested countries.

- Supply Chains and Geopolitics: Mobility tech relies on complex global supply chains. For instance, a single electric car may have a battery from South Korea, semiconductors from Taiwan, software from California, and be assembled in Mexico. **Geopolitical tensions** (trade wars, conflicts) can disrupt these flows and thus mobility adoption. The 2021–2022 chip shortage (partly due to global supply issues) slowed car production worldwide, highlighting this vulnerability. In the future, the race for **semiconductors for autonomous vehicles and AI** could spur either international cooperation (through trade agreements ensuring supply) or protectionism (each region trying to self-produce). The

availability of **raw materials** like lithium could become a strategic factor akin to oil in the past – countries like Bolivia (lithium-rich) might become as crucial as Saudi Arabia. The U.S. is already strategizing to onshore or "friend-shore" these supply chains (e.g., battery factories in US, lithium trade with allies). By 2045, we might see a more regionally balanced production network as a result, which could make North America more self-sufficient in mobility tech. However, if geopolitics take a dark turn (hypothetically, a bifurcated world where technology standards split), the U.S. might have to ensure compatibility between, for example, Chinese-made and Western-made autonomous systems, or risk fragmentation (similar to how GPS vs BeiDou satellites or 5G standards battles played out). Ideally, the global nature of climate and technology needs will push toward **interoperability and collaboration** rather than fragmentation.

In essence, **global interdependence** means no mobility development happens in a vacuum. U.S. researchers and policymakers must scan internationally for **innovative ideas, policy outcomes, and partnership opportunities**. Whether it's learning from Oslo's success eliminating downtown parking for bike lanes (mckinsey.com), teaming up with Europe on battery recycling initiatives, or participating in global regulatory bodies for AVs, engaging globally will help the U.S. navigate its mobility future more effectively. It also means being prepared for external shocks or leaps – for example, if another country discovers an AI algorithm that revolutionizes traffic flow, how quickly can the U.S. adopt it? Conversely, the U.S. can lead in areas like aerospace or software and shape global practices. The **mobility future is a shared one**, especially as climate change ties destinies together – innovations in any corner of the world can and will propagate to others, and collective action (or inaction) will determine how sustainable and accessible mobility is planet-wide by 2045.

Constraints and Enablers on the Road Ahead

As we contemplate these futures, it's critical to recognize the **constraints that could slow or derail progress** and the **enabling factors that can propel change**. Below is a summary of key challenges and opportunities that will shape the trajectory of mobility in the U.S. (and globally) over the coming 5, 10, and 20 years:

- Constraint – Infrastructure Limitations: Aging and capacity-limited infrastructure is a major bottleneck. The electric grid needs massive upgrades to handle EV charging (potentially hundreds of terawatt-hours of new demand (reuters.com)). Without reinforcement and smart management, widespread EV adoption could strain local grids. Similarly, road and

transit infrastructure requires renewal and expansion – decades of underinvestment mean that even maintaining the status quo is hard, let alone building new systems like high-speed rail or dedicated AV lanes. Overcoming this requires sustained funding and political will; otherwise, bottlenecks (like too few chargers or congested highways) could stunt mobility innovations.

- Constraint – Regulatory and Political Uncertainty: Mobility evolution often outpaces regulation. Autonomous vehicles, for example, may be ready technologically before laws allow full deployment. Fragmented authority in the U.S. (federal vs state vs local rules) can impede uniform adoption (we see this with differing AV testing rules by state). Political swings and polarization add uncertainty – a supportive policy (e.g., EV tax credits or transit funding) could be rolled back by a future administration, halting progress. *Consistent, long-term policy frameworks* are hard to maintain in this environment. Additionally, lengthy project approval processes (environmental reviews, community opposition) can delay infrastructure projects well beyond the 5- or 10-year horizon, pushing benefits farther out.

- Constraint – Public Acceptance and Behavioral Inertia: Technology is only as good as the public's willingness to use it. **Trust in autonomous vehicles** is a hurdle – any high-profile AV crashes or cyber-attacks could sour public opinion and lead to strict regulations. Privacy concerns around connected cars and apps might cause pushback on data sharing that many smart mobility solutions rely on. Culturally, Americans have deep ties to car ownership and driving freedom; changing that mindset (especially in regions that lack good alternatives) could take longer than expected. There may be *generational tension*: older folks might resist giving up steering wheels, while young people embrace new modes – policy must bridge this gap. Public outreach and education will be necessary to build acceptance of things like road pricing, vehicle sharing, and even something as radical as giving up car ownership entirely.

- Constraint – Cybersecurity and System Resilience: As mobility becomes more digitized and connected, it becomes vulnerable to cyber threats. A coordinated hack on connected vehicles or transit systems could cause chaos or erode trust. Imagine a ransomware attack that immobilizes thousands of autonomous cars, or drones being hijacked – these scenarios keep security experts up at night. Similarly, heavy reliance on central control (like traffic AI managing a whole city) introduces single points of failure. **Ensuring robust cybersecurity, redundancy, and fail-safes** is essential, but it's an ongoing race against malicious actors. Without confidence in security, deployment of connected mobility tech could be slowed by regulators or insurance concerns.

- Constraint – Equity and Access Gaps: Without deliberate action, there's a risk that new mobility tech could worsen inequality. For example, early AV or air taxi services might

serve only wealthy neighborhoods or business districts, leaving lower-income or rural areas behind. If transit funding dwindles in favor of shiny tech used by the affluent, those who rely on basic buses could suffer. The **digital divide** is a factor too – not everyone has access to smartphones or banking needed for app-based services. Planners must proactively ensure **equitable deployment** (like requiring AV fleets to serve all zip codes, or subsidizing fares in underserved communities) so that mobility advances benefit society broadly. If not, social backlash or justified resistance could slow down projects (community opposition to robotaxi testing, etc., citing that it doesn't help them). Equity isn't just a moral imperative; it's key to political durability of mobility innovations.

On the flip side, there are powerful **enablers and opportunities** that can accelerate positive change:

- Enabler – Rapid Technological Advances: The pace of innovation in AI, materials, and energy is a huge tailwind. Breakthroughs can remove what looks like a barrier today. For instance, battery technology: if solid-state batteries become commercially viable by late 2020s, EVs will get cheaper, lighter, and longer-range, addressing cost and range anxieties and possibly making electric aviation much easier. Advances in artificial intelligence and quantum computing could solve routing and optimization problems that currently limit efficiency. 5G and next-gen connectivity enable V2X (vehicle-to-everything) communications with near-zero latency, which can unlock cooperative automation (platooning, intersection coordination) that greatly boosts road capacity without building new lanes (allianz-partners.com). Technology can also lower costs – autonomous driving, once perfected, can make taxi services far cheaper than car ownership, which by itself can prompt many to shift modes for economic reasons. In short, continued Moore's Law-type progress in computing and exponential improvement in sensors (LIDAR costs have dropped from $75k units to a few hundred dollars in a decade) will make advanced mobility tech affordable and practical for mass deployment.
- Enabler – Strong Federal and State Support: Government action is a decisive factor. The recent infrastructure bill and climate-oriented investments (like the Inflation Reduction Act) are prime examples – they inject billions into EV charging, transit, rail, R&D, etc (mckinsey.comitdp.org). Over 5–10 years, these can catalyze private investment and give certainty to innovators. If the federal government continues on this path – for example, implementing national autonomous vehicle safety standards, funding big transit expansions, or even establishing a carbon pricing mechanism – it will provide the foundation on which new mobility ecosystems can flourish. States and cities can be laboratories as well: California's clean vehicle mandates or a city's experiment with no-car zones, if successful, can be scaled up nationally. Public-private partnerships are an

opportunity to leverage support: government can de-risk projects that the private sector might not do alone (like first-of-a-kind hyperloop tracks or electric highway pilots). The 2020s show a renewed federal interest in infrastructure; keeping that momentum (perhaps with a Green New Deal-type comprehensive approach) would greatly enable the envisioned changes by 2045.

- Enabler – Shifting Cultural Values: There are signs that cultural values around mobility are changing in ways that favor sustainable, shared modes. Young generations value environmental sustainability and convenience over ownership. Surveys show large percentages of people are willing to use shared mobility or give up car ownership for better options (mckinsey.com). The concept of the "American Dream" car ownership is being redefined – many urban millennials and Gen Z would rather have high-speed internet and a good location than a car. As these cohorts make up a larger share of voters and consumers, political and market support for things like transit funding, bike lanes, climate policy, and innovative services increases. Also, aging populations ironically can help push AV adoption – older folks stand to gain independence from self-driving cars and robotic assistants, so AARP and others may become allies for AV-friendly regulation once the tech is proven to help seniors. Broadly, the narrative of what constitutes a "modern, desirable city" is shifting: in the 20th century it was freeways and parking; now it's transit, bikeability, and tech-enabled convenience. This cultural evolution is an enabler because it reduces resistance to projects (NIMBYism might soften if people genuinely want a rail line or dense development) and increases market demand for new mobility solutions.

- Enabler – Climate Imperative and Global Agreements: While climate change is a threat, it is also a catalyst for action. The clear scientific need to cut emissions pushes governments, companies, and individuals to innovate and change behavior. The transportation sector being a large emitter (~20% of global GHG (mckinsey.com)) means it's a focus of climate policy. We've already seen stronger fuel economy standards, EV incentives, and city policies (like emissions zones) as a result. Going forward, if climate impacts worsen, the public may support even bolder measures (e.g., banning gas vehicles sooner, heavily taxing jet fuel, etc.). Internationally, as noted, countries are coordinating on climate – agreements can set targets that translate into domestic policy (for example, a future international deal to make all new trucks zero-emission by 2040 would force industry compliance). Investor pressure is another opportunity: ESG (Environmental, Social, Governance) investing trends mean big funds are pushing automakers and others to clean up their act, which in part drove GM and Ford to announce electric transitions. The climate imperative essentially aligns the long-term public good with the direction of innovation. It helps justify upfront costs ("spend trillions on new infrastructure now to save the planet and avoid disaster costs later"), a narrative that can unlock funding.

- Enabler – Integration of Mobility and Technology Sectors: We're witnessing a merging of industries – tech companies are in transport (Google with Waymo, Apple reportedly working on cars), and automakers are becoming software companies. This cross-pollination brings new expertise and capital into mobility. The more the mobility ecosystem integrates with Silicon Valley-style innovation, the faster we'll see developments. For example, applying machine learning broadly to traffic management, or using big data from smartphones to redesign bus networks in real-time. Startups continue to pop up bringing fresh ideas – from Hyperloop concepts to AI traffic light startups to new mobility-as-a-service platforms. The dynamism of the tech sector acts as an enabler that keeps pushing the envelope, often leapfrogging slow-moving traditional players. Additionally, cooperation between sectors – say energy and transport (utilities working with EV charging companies to use car batteries for grid stability) – creates synergies that accelerate adoption (making EVs more economically attractive as they can earn money feeding the grid in peak times, for instance).

Ultimately, **navigating these constraints and leveraging enablers** will determine how the mobility scenarios play out. Policymakers and stakeholders should work to mitigate constraints: invest in infrastructure, update regulations nimbly, build public trust through transparency and pilot programs, harden cyber defenses and ensure equitable access. Simultaneously, they should double down on enablers: support R&D, keep funding flowing for successful programs, educate and harness public sentiment for sustainable mobility, and collaborate across sectors and borders. With foresight, the U.S. can overcome the hurdles and ride the wave of enabling trends to realize the forward-looking vision outlined in this briefing.

Conclusion: Navigating the Future Mobility Landscape

The coming 5, 10, and 20 years herald a **once-in-a-century transformation** in how we move. The analysis above paints a picture of a future that is at once exciting – electric vehicles, autonomous pods, 15-minute cities, hyperloops – and challenging, given the social, technical, and political hurdles that must be overcome. For researchers, planners, and policymakers, the task now is to **navigate this complex sociotechnical landscape** proactively:

- In the **5-year horizon**, focus is needed on deploying what is ready (EVs, charging networks, transit enhancements) and experimenting with emerging tech (AV pilots, drone trials) while formulating the policies (safety rules, incentives) that will guide their growth

mckinsey.comreuters.com). Early decisions and investments will lay the groundwork for the next decade – it's a tactical period to build momentum and correct course on legacy issues (fixing infrastructure, addressing transit's pandemic recovery).

- In the **10-year horizon**, many streams converge. This strategic period will likely determine if we lock in a path toward sustainable, efficient mobility or if we entrench old patterns with new gimmicks. By 2035, we should see measurable outcomes: a significant dent in emissions, safer roads, more transport options for all demographics, and global competitiveness in mobility industries. It's a time to scale up successful models (e.g., expand an autonomous shuttle service citywide if it proved safe in a pilot (mckinsey.com), or build out a regional rail network after initial segments show promise) and to adjust strategies where needed (perhaps early AV predictions were too optimistic – then double-down on transit and active modes to fill the gap, or vice versa). International benchmarking will be crucial – if another country cracks a solution (like Germany's hydrogen trains in revenue service, or Nairobi's electric bus corridor), the U.S. should be ready to adopt and adapt it (mckinsey.comafricainsight.co.ke). Mid-term planning also must integrate climate adaptation – ensuring transport networks remain resilient by design through 2040 and beyond.
- In the **20-year horizon**, transformational goals need to be realized. This means keeping an eye on the big picture: **What kind of cities and society do we want in 2045?** If the answer is "clean air, minimal traffic deaths, equitable access, convenient and carbon-free travel," then all the intermediate steps (from now to then) should be aligned to that vision. Researchers should use tools like scenario planning (as we did here) to test policies against various futures (e.g., what if AVs are widespread vs. what if they remain limited – do we have flexible plans for either case?). Technological forecasting and **"backcasting"** (starting from a desired 2045 outcome and working backward to identify actions to take by 2030, 2025, etc.) can help ensure that short-term actions contribute to long-term transformation, rather than lead to dead ends.

One overarching theme is **integration**: technological integration (vehicles talking to infrastructure reuters.com), apps integrating model (mckinsey.com)), integration of policy domains (transportation policy meshing with energy policy, land use, digital infrastructure), and integration across jurisdictions (regional and international cooperation). Siloed approaches won't suffice in this complex era. For example, electric vehicles intersect energy and transport – policies must ensure the grid is greening alongside vehicle electrification, or else emissions just shift from tailpipes to power plants (reuters.com). Autonomous vehicles intersect tech and law – requiring new legal frameworks, ethical considerations, and workforce retraining plans all at once.

Finally, continuous **monitoring and research** is essential. The mobility revolution will generate vast amounts of data (from vehicle sensors, travel patterns, etc.) – researchers can harness this data to gain insights and refine models. It will be important to track metrics: mode share changes, emission levels, congestion indices, accessibility scores for communities, etc., to know if we're on the right track. Surprises will happen (who predicted the micro-mobility explosion 10 years ago, or the impact of a pandemic on travel?). An agile approach, where policies and plans are updated as new evidence comes in, will outperform rigid schemes.

The future of travel and mobility in the U.S. is **full of promise**. Imagine in 20 years a person can travel from their quiet, green neighborhood (once a former parking lot) via a quick autonomous shuttle to a mobility hub, hop on a hyperloop or high-speed train to another city, and then grab a shared e-bike for the last block – all in a fraction of the time and environmental impact it takes today, and all easily accessed regardless of age or income. This briefing has explored how we might get there through tactical steps in 5 years, strategic moves in 10, and bold changes in 20, drawing on current trends and global inspirations.

The journey will not be simple, but the road (or perhaps tube or skyway) to 2045 can lead to a more connected, efficient, and humane mobility future if we navigate it with ingenuity and foresight. As we've seen, the pieces are already falling into place – it's up to today's researchers and decision-makers to assemble them wisely. Continued study, cross-sector collaboration, and imaginative yet evidence-based planning will be our vehicles on this journey. The transformation of mobility is underway; with careful steering, we can ensure it accelerates us toward a better future.

Sources:

This briefing drew on a wide array of sources, including scenario studies (RAND's 2030 mobility scenarios (rand.org)), industry forecasts (McKinsey, Deloitte, KPMG reports on mobility trends (assets.kpmg.com, mckinsey.com)), technological benchmarks (Reuters, IEEE data on EV and AV adoption (reuters.com, mckinsey.com), urban policy case studies (global city initiatives from Paris to Chengdu (mckinsey.com, mckinsey.com)), and futurist projections (Allianz Partners 2040 scenario (allianz-partners.com, allianz-partners.com)). These citations and examples provide a

fact-based foundation for the forward-looking insights above, and readers are encouraged to explore them (and the footnoted references throughout) to delve deeper into specific topics of interest. The future is, of course, uncertain – but by studying the trends and learning from diverse experts and experiences, we can approach that uncertainty with informed optimism and strategic preparedness.