



M E M O R A N D U M

Agenda Item 5a

TO: Planning Committee
FR: Executive Director
RE: Perspective Paper #1 Preview - Autonomous Vehicles

DATE: June 1, 2018

Background

Automated or autonomous vehicles (AVs) may be the most significant change to transportation since Henry Ford first made automobiles accessible to the working class. The technology is likely to have a profound impact on the Bay Area. AVs use an array of technological systems, including GPS, radar, and LIDAR backed by powerful computers and machine learning to navigate complex driving environments. With AV technologies, vehicles will eventually be capable of driving themselves – human operators and occupants optional. This capability could have dramatic implications for personal mobility, public transportation, and the movement of goods.

This report is the first in a series of *Perspective Papers* that will contribute to *Horizon*, a regional initiative exploring a range of external forces that have the potential to fundamentally alter the region's trajectory. The *Autonomous Vehicles Perspective Paper* focuses on priority policy interventions and planning strategies for the Bay Area to seize opportunities and proactively address challenges that AVs are likely to introduce. The strategies advanced via this report will be incorporated across a series of divergent *Futures* (planning scenarios), depending upon a range of assumptions including AV penetration, sharing preferences, and electric vehicle penetration.

Bay Area AV Pilot Programs and Policy Responses

Many communities in the Bay Area are beginning to proactively explore applications of AV technology. For instance, the City of San Jose has advanced a series of pilot programs to develop communications infrastructure, implement spatial data collection, and provide service with Level 4 (high automation) fleets. GoMentum Station (Concord) is a robust AV testing facility with city-like road networks, tunnels, over- and under-passes, and railroad crossings that accurately simulate real-world conditions. Bishop Ranch (San Ramon) is piloting AV shuttles to transport workers around the office park. The pilot will move into its final phase this year, operating outside of the office park to connect with local transit.

In addition to the explicit AV pilot programs, many other entities are exploring future-facing policies, programs, and regulations. The San Francisco Municipal Transportation Agency (SFMTA) recently developed *Guiding Principles for Emerging Mobility*, a policy framework to evaluate new mobility services for all SFMTA and SFCTA decisions. The Santa Clara Valley Transportation Authority (VTA) is developing an *Automated Driving System Draft Policy*, an effort to address the issues and opportunities AVs present and explore pathways to incrementally introduce automation into VTA's business model and practices. Finally, the California Public Utilities Commission (CPUC) has moved forward on releasing a proposed framework for regulating two AV pilot programs, one with drivers in the vehicle, and one without drivers in the vehicle.

Opportunities, Risks, and Strategies for the Bay Area

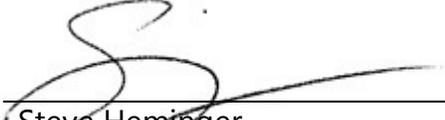
There remains tremendous uncertainty related to the timing and overall market penetration of autonomous vehicles, the extent to which driverless vehicles will be shared rather than owned, and the impacts they could have on labor, public transit, congestion, air quality, safety, and equity. To corral these uncertainties, the *Perspective Paper* relies heavily on the Horizon Guiding Principles— Affordable, Connected, Diverse, Healthy, and Vibrant— to describe the opportunities and risks of an AV future. For example, under the *Connected* principle, the Paper describes the opportunity that shared AV services could introduce a transit renaissance with improved on-demand services. However, there is also a risk that AVs would worsen congestion with more induced travel and empty vehicle circulation.

The Paper then turns to a shortlist of “priority strategies” to seize the opportunities or overcome the risks. Sticking with the *Connected* principle example, the paper describes the importance of pricing mobility fairly, designing smart streets, developing industry-wide data sharing protocols, and re-envisioning investments and innovations in our public transit system. While the presentation today focuses on a “shortlist” of strategies, the final *Perspective Paper* will also include a longer list of potential policy responses to explore, with more detail on feasibility and effectiveness. The Paper will also detail pilot programs and policy responses from across the U.S., and review the best available recent literature on the topic.

Next Steps

The *Automated Vehicles Perspective Paper* introduces opportunities and risks, while also introducing a set of priority strategies for the region to consider. It is important to emphasize that the paper is intended to serve as an interim deliverable of the overall *Horizon* process. The strategies described in the Paper serve as a starting point for a more robust discussion this fall, when MTC and ABAG staff will engage stakeholders on strategies that can overcome various challenges facing the region across multiple *Futures*. This process will identify a narrowed-down list of strategies most effective in multiple futures to carry forward into Plan Bay Area 2050.

Finally, MTC and ABAG will hold a public event releasing the Autonomous Vehicles Perspective Paper on the evening of Tuesday, June 26, 2018, here at the Bay Area MetroCenter, 375 Beale Street, San Francisco. The event will highlight a similar presentation of the material and engage experts and the audience in a panel discussion about these topics.



Steve Heminger

Attachment:

- Presentation

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HORIZON

Autonomous Vehicles Perspective Paper

Strategies for the Bay Area

Horizon is exploring how economic, environmental, technological, and political uncertainties may create new challenges – or exacerbate existing ones – for the Bay Area over the coming decades.

H O R I Z O N

Futures Planning

Perspective Papers

Project Performance

PLAN BAY AREA 2050

For more information, go to:
mtc.ca.gov/horizon

Source: <https://www.flickr.com/photos/kitkit201/33692723984/>

Overview

- **Autonomous Vehicles 101**
- **Implications and Strategies**
 - Horizon Guiding Principles
 - Opportunities and Risks
 - “Big Ideas” and Applications for the Bay Area
- **Next Steps**



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Autonomous Vehicles 101

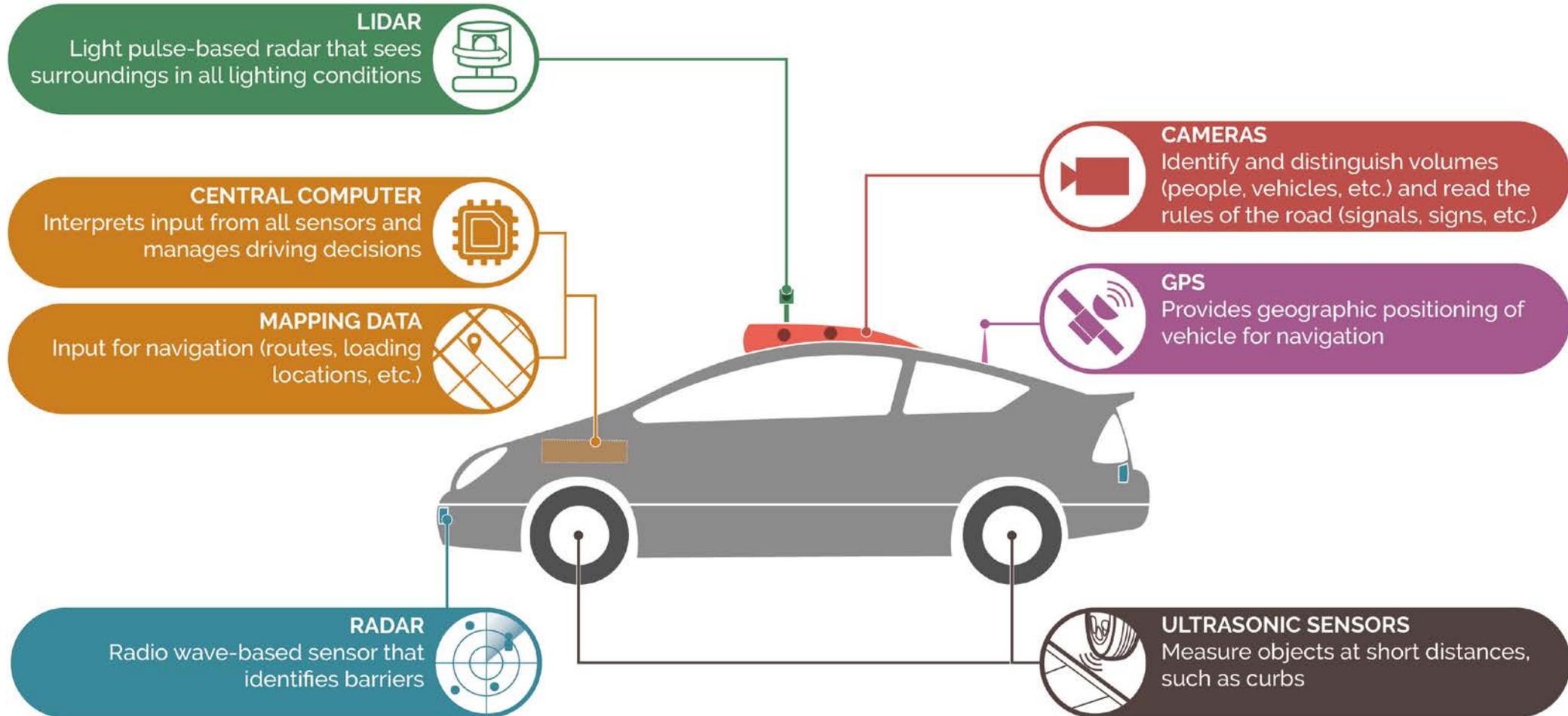
“Automated” versus “Connected”

AUTOMATED The increasing ability to drive without human assistance.

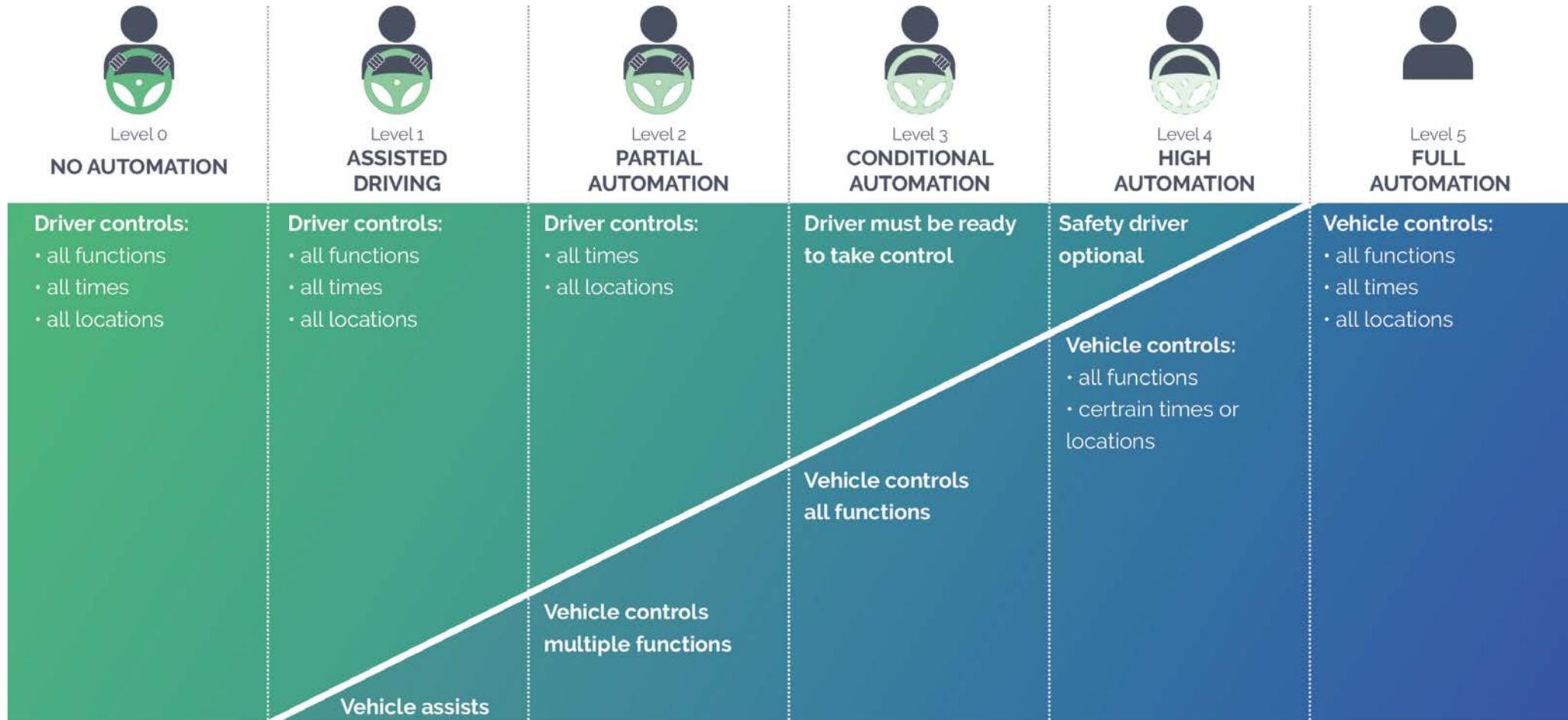
CONNECTED The increasing ability to share mobility or safety information among other vehicles, infrastructure, systems, etc.

None of the automation technologies require a vehicle to be connected.

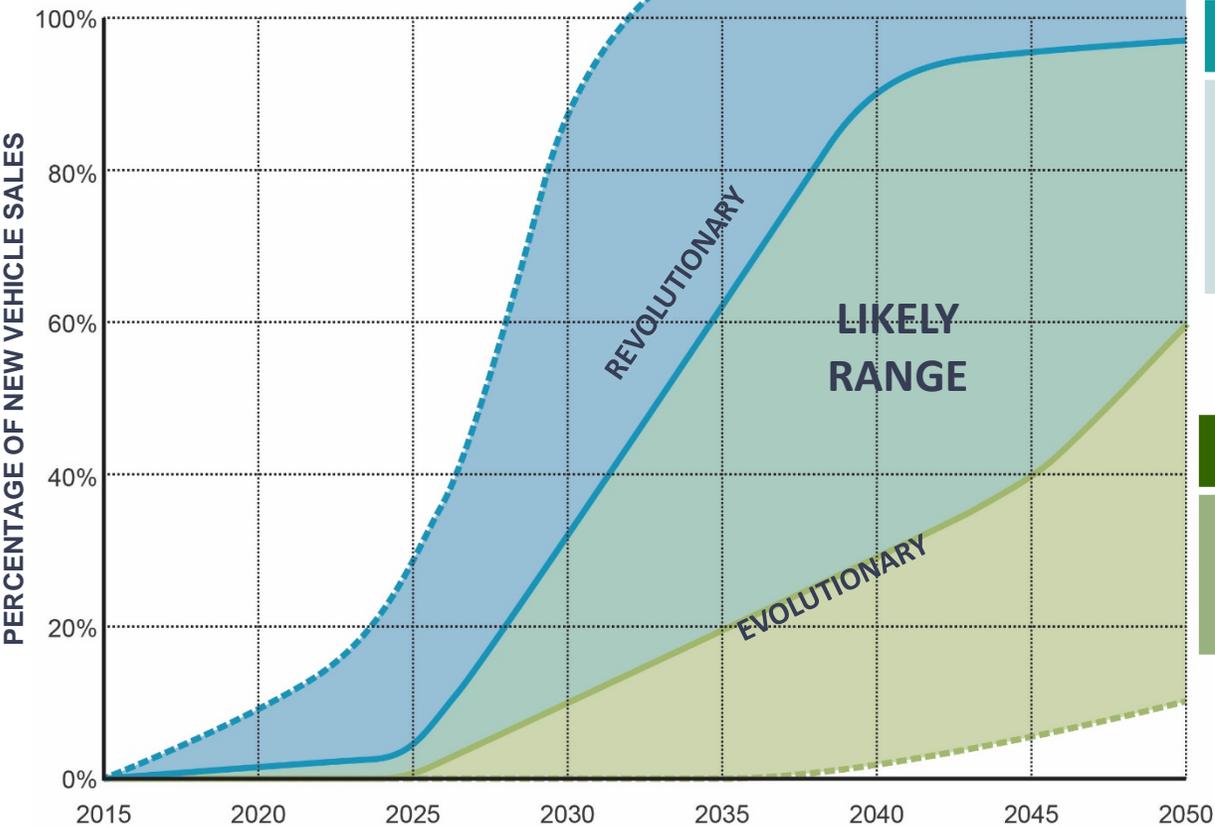
Autonomous Vehicles Components



Levels of Automation



When do AVs become commonplace?



Fully Autonomous Vehicle (L4/5) uptake predictions based on high disruption scenarios, indicates possible percentage of new car sales 2016 to 2050.

Revolutionary

- Technology breakthroughs
- Regulatory resolutions
- Shared model, at much lower cost than ownership
- Rapid adoption

Evolutionary

- Slower technology development and rollout
- Owned AV model with cost premium
- Slower adoption

The future is highly uncertain

TIMING 3 to 13 years until L5 AVs available for purchase

SAFETY +40% to +90% increase in safety

CAPACITY 0% to +45% increase in roadway capacity

DEMAND +5% to +40% increase in VMT

ENERGY/EMISSIONS -50% to + 100% change in GHGs

Bay Area Pilot Programs and Companies

Guiding Principles for Emerging Mobility, San Francisco

Lead Agency: SFMTA

Policy framework to evaluate new mobility services for all SFMTA and SFCTA decisions, including:

- Safety
- Transit
- Equitable Access
- Disabled Access
- Sustainability
- Congestion
- Accountability
- Labor
- Financial Impact
- Collaboration

Companies licensed to test AVs on California public roads

- | | |
|------------------------------------|---------------------------|
| Almotive | NVIDIA |
| Apex.AI | Phantom AI |
| Apple | PlusAi |
| Aurora Innovation | Pony.AI |
| AutoX Technologies Inc | Qualcomm Technologies |
| Baidu | Renovo.auto |
| Bauer's Intelligent Transportation | Roadstar.AI |
| BMW | SAIC Innovation Center |
| Bosch | Samsung Electronics |
| Continental Automotive Systems | SF Motors Inc. |
| CYNGN | Subaru |
| Delphi Automotive | Telenav |
| Drive.ai | Tesla Motors |
| Ford | Toyota Research Institute |
| GM Cruise | Uber |
| Jingchi CorpLyft | Udacity |
| Mercedes Benz | Valeo North America |
| NIO | Volkswagen |
| Nissan | Voyage |
| Nullmax | Waymo |
| Nuro | Zoox |

GoMentum Station, Concord

Lead Agency: CCTA

- Robust testing facility with city-like road networks, tunnels, over-and under-passes, and railroad crossings that simulate real world conditions.
- Testing partners include EasyMile (low-speed electric shuttles), Honda (passenger AVs), Toyota (passenger AVs), Otto (long-haul automated trucks), and Sumitomo Electric (supplier of electronics).

Shared Autonomous Vehicle Demonstration

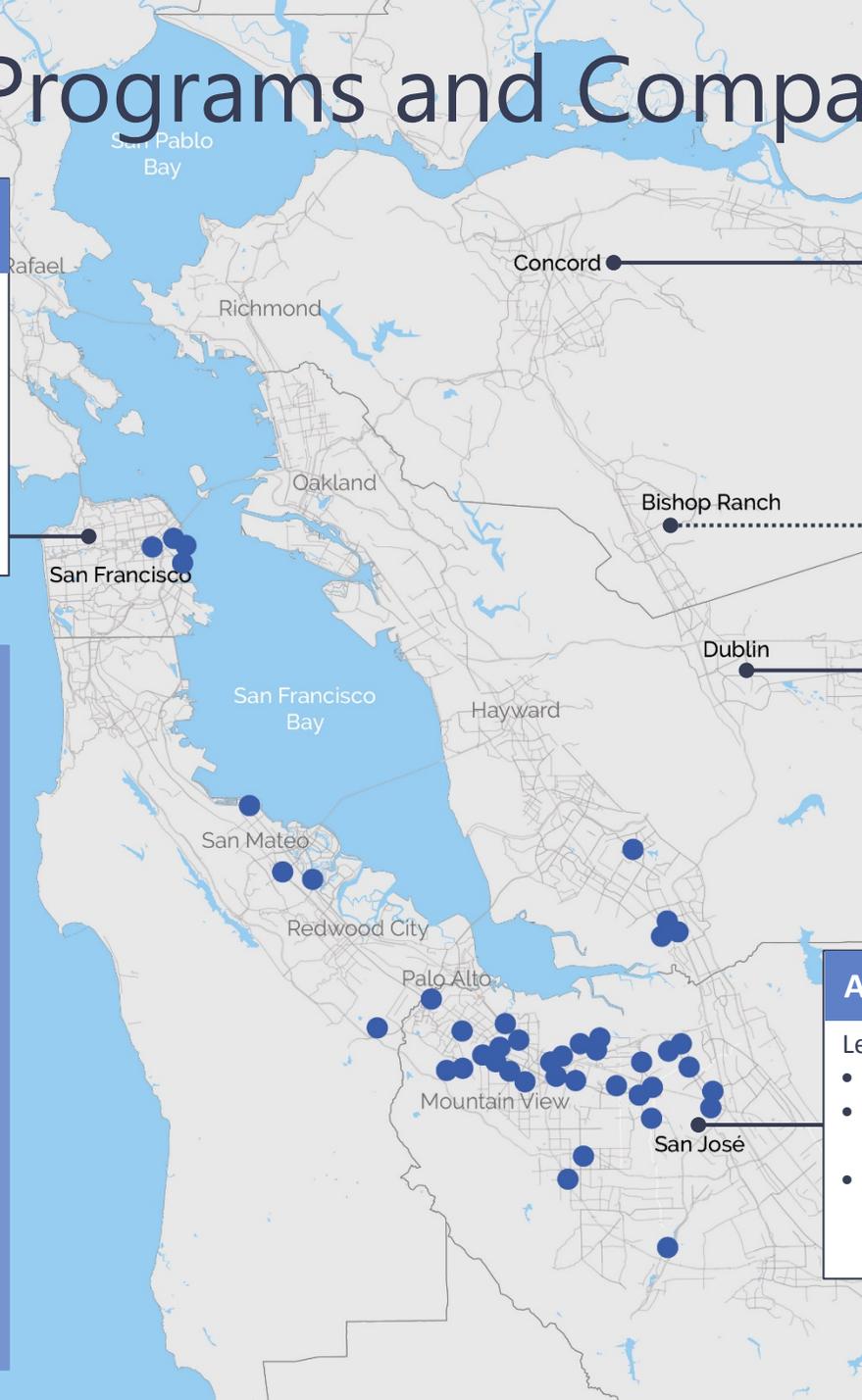
Lead Agency: LAVTA

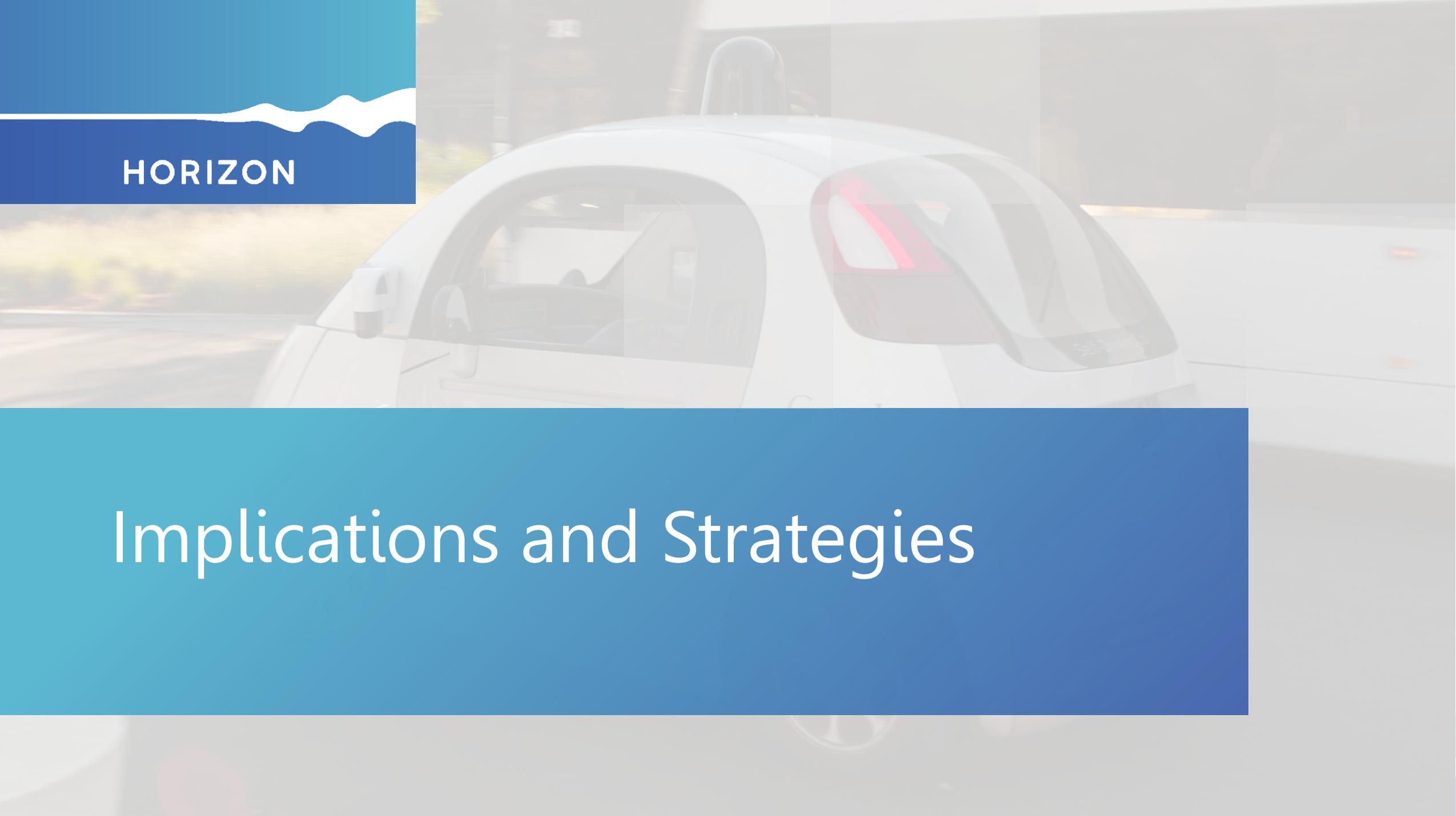
- First/Last mile to Dublin-Pleasanton BART station
- Low speed autonomous shuttle on public streets
- Complements fixed route buses
- Funded with BAAQMD Grant
- Partnership with County Connection, GoMentum Station, City of Dublin

AV Pilot Program, San José

Lead Agency: City of San José

- RFI for how AVs could help advance broader goals for the city.
- Six specific project areas for AV deployment, but allowed respondents to propose their own project areas.
- Two main pilot programs: small-area or corridor-specific transit service and technology to support broader AV operations in the future.





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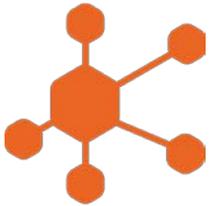
Implications and Strategies

The San Francisco Bay Area Aspires To Be:



AFFORDABLE

All Bay Area residents and workers have sufficient housing options they can afford – households are economically secure.



CONNECTED

An expanded, well-functioning transportation system connects the Bay Area – fast, frequent and efficient intercity trips are complemented by a suite of local transportation options, connecting communities and creating a cohesive region.



DIVERSE

The Bay Area is an inclusive region where people from all backgrounds, abilities, and ages can remain in place – with access to the region's assets and resources.



HEALTHY

The region's natural resources, open space, clean water and clean air are conserved – the region actively reduces its environmental footprint and protects residents from environmental impacts.

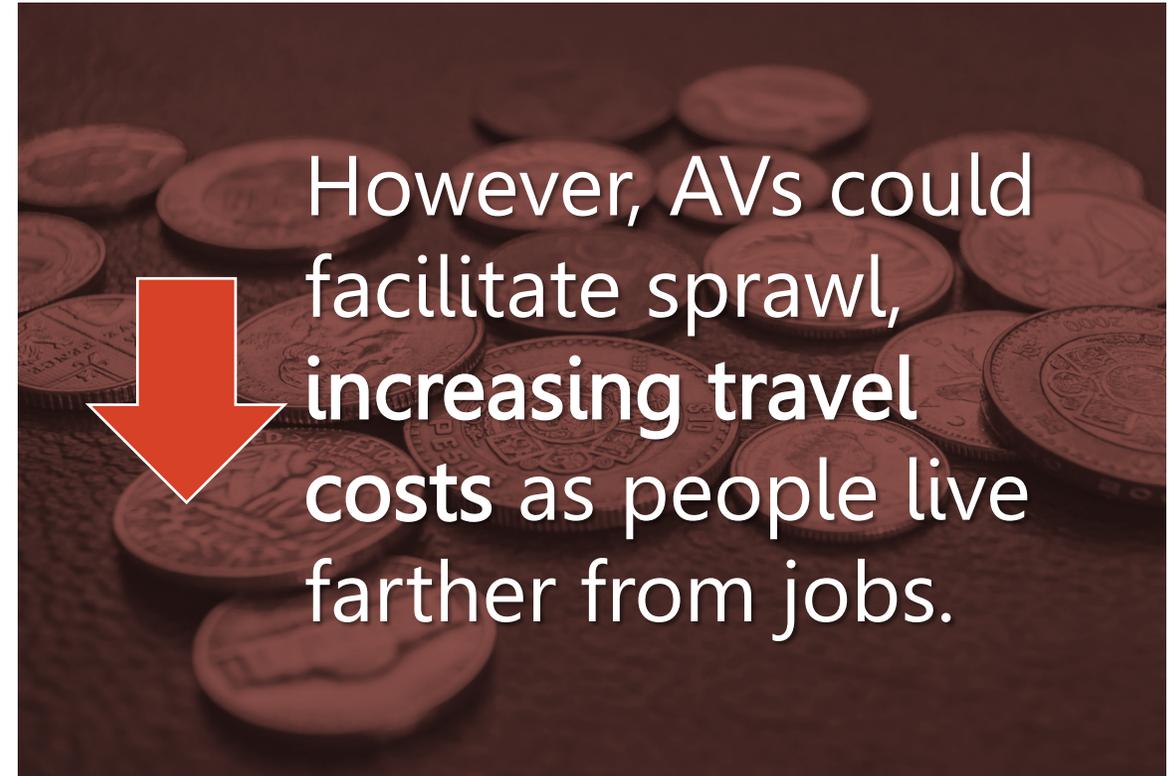


VIBRANT

The Bay Area region is an innovation leader, creating quality job opportunities for all and ample fiscal resources for communities.



For lower income households, housing and transportation costs could increase to 67% of household budgets by 2040.



Housing Opportunity Sites



AFFORDABLE



- Decreasing parking **demand** with AV services
- Reduce parking **requirements**
- Obsolete parking could be replaced with **infill development**

Priority Strategies

Repurpose off-street parking for **infill development**

Institute **parking maximums** for both on- and off-street parking supply

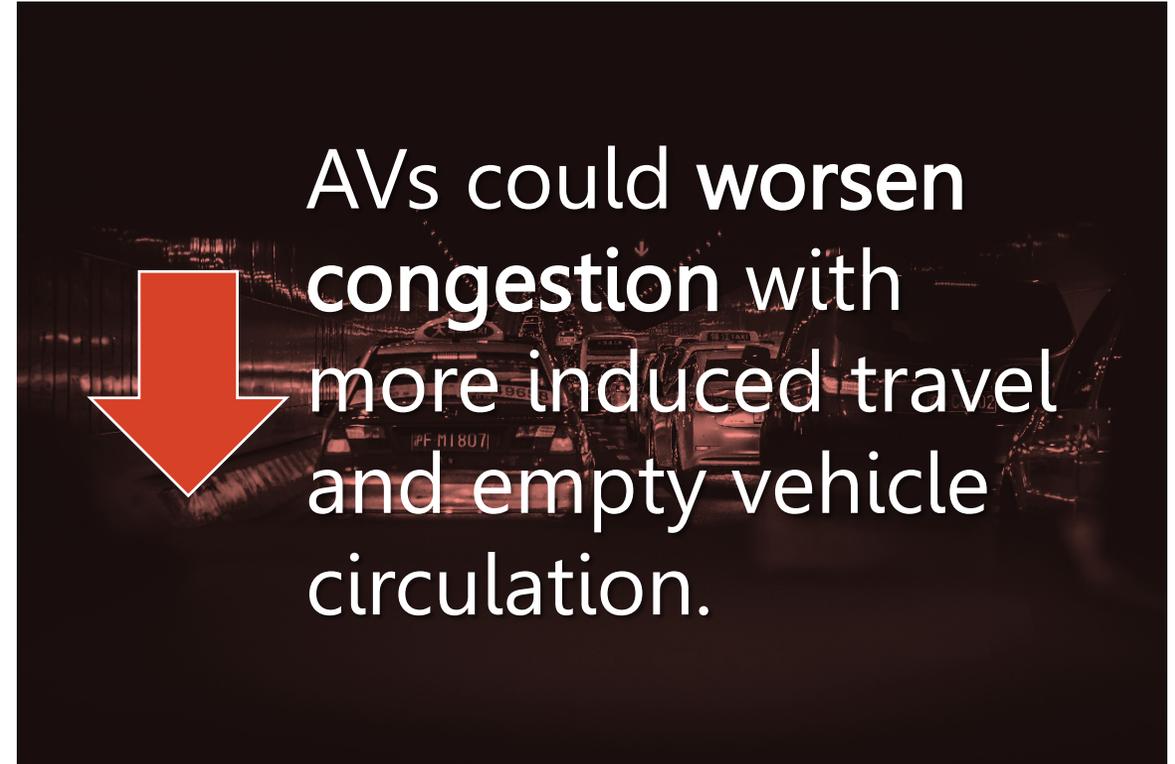
Retain urban growth boundaries to **control greenfield development**



Congestion in the Bay Area has worsened 64% since 2000, putting Bay Area traffic worst in the nation behind only Los Angeles.



Shared AV services could introduce a transit renaissance with improved on-demand services.



AVs could worsen congestion with more induced travel and empty vehicle circulation.

Regional On-Demand, Autonomous Microtransit



CONNECTED

- High frequency regional **trunk lines** + on demand local service
- Autonomous **BRT** network
- On-demand, **door-to-door** and first/last-mile service
- **Mobility as a Service** models

- Railway network
- Railway: Future Extension
- Autonomous BRT / Urban Bus
- Intercity Express Bus
- Suburban Microtransit



Priority Strategies

Double down on high-capacity bus and rail corridors

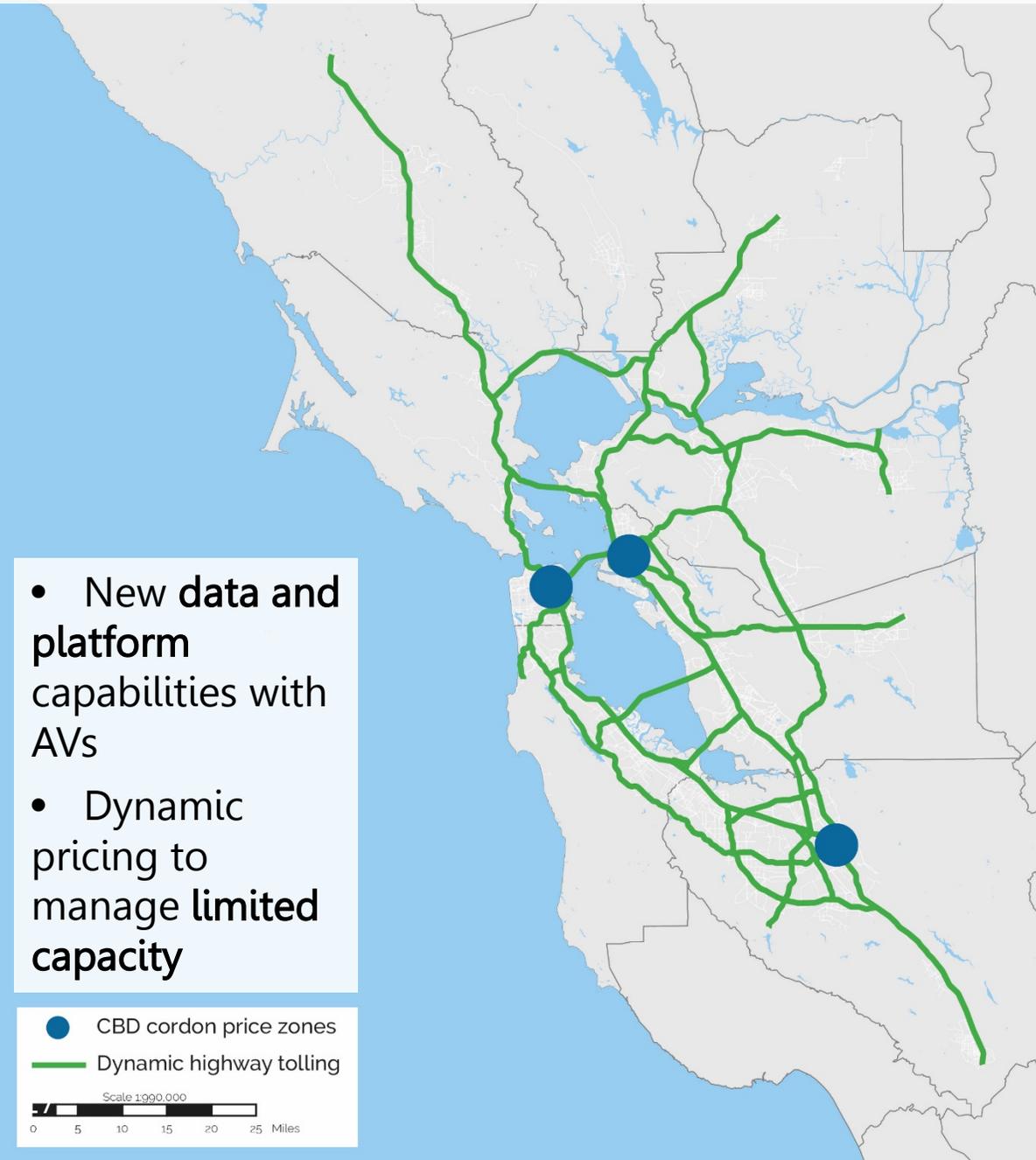
Innovate suburban transit with autonomous, on-demand microtransit

Develop a mobility as a service platform to provide a unified and equitable gateway to services and information

Price Mobility Fairly



CONNECTED



- New data and platform capabilities with AVs
- Dynamic pricing to manage **limited capacity**

- CBD cordon price zones
- Dynamic highway tolling

Scale 1:990,000

0 5 10 15 20 25 Miles

Priority Strategies

Price mobility fairly through dynamic road user charging

Design smart streets with dynamic allocation of street and curb space

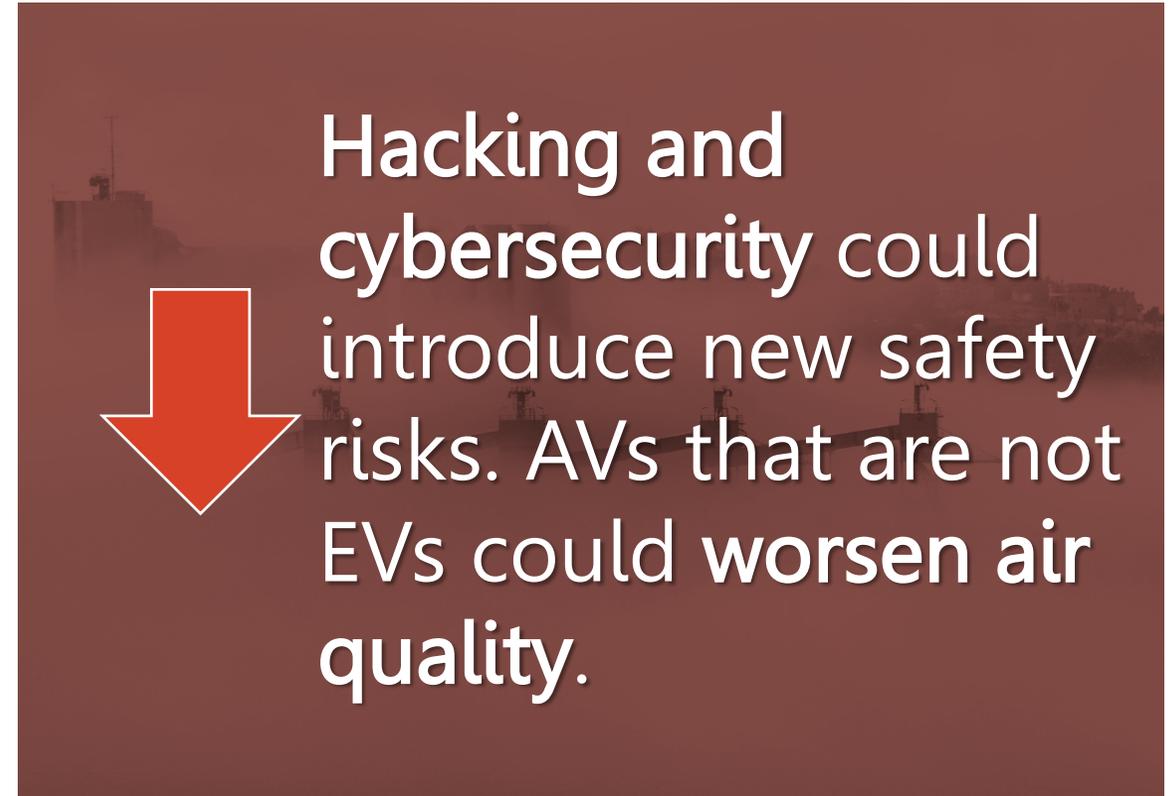
Develop industry-wide data sharing protocols to provide real-time information to connected vehicles



Over the last 15 years, more than 6,500 people have died on Bay Area roads with an average of 6 in 100,000 residents losing their lives in traffic incidents.



Significant reduction in human driving error could **save lives**. AVs that are EVs could **improve air quality**.



Hacking and cybersecurity could introduce new safety risks. AVs that are not EVs could **worsen air quality**.

Vision Zero 2.0



- Train **first responders**
- Address **cybersecurity** vulnerabilities
- Mandate **eco-driving**
- **EV** incentives and sharing infrastructure
- **Vehicle-to-grid** innovation

Priority Strategies

Cap speed limits in downtowns, neighborhoods

Mandate that **all AVs are EVs** and invest in the necessary infrastructure

Develop hacking vulnerability “bounty program”



Nearly 600,000 people were employed in the trade, transportation, and utilities industry in 2016.



AVs have the potential to reduce transportation and logistics **operating costs.**



AVs could cause rapid **job loss** or a shift to other occupations.

"New Deal" for Mobility



VIBRANT

- Comprehensive program to maximize local **economic benefits** of the AV industry
- **Workforce advancement** programs
- Related **new industries** (manufacturing, data, services, goods, repair, etc.)

Priority Strategies

Strengthen the capacity of **training programs** to expand opportunities for workers in the AV industry

Target job clusters on **industrially-zoned land** for production, distribution, and repair

Pilot **innovative AV applications** that could spur new job opportunities

Racial minorities now make up 59% of the Bay Area's population.



Require Equitable Outcomes



DIVERSE

- **Require accountability:** targets, metrics, monitoring, improvement
- Target strategies for **specific equitable outcomes.**
- Focus all strategies on **inclusive prosperity.**

Priority Strategies

Mandate **equitable provision** of mobility services with transparent reporting

Subsidize public transit innovations replacing fixed route transit in Communities of Concern

Establish **prioritization programs** for AV mobility services that target Communities of Concern

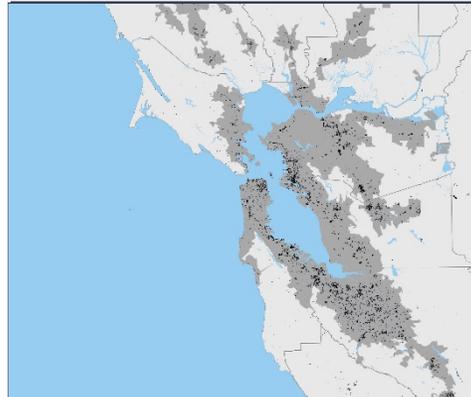
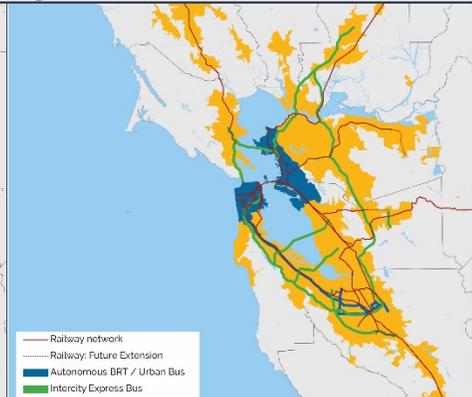
 **Affordable**

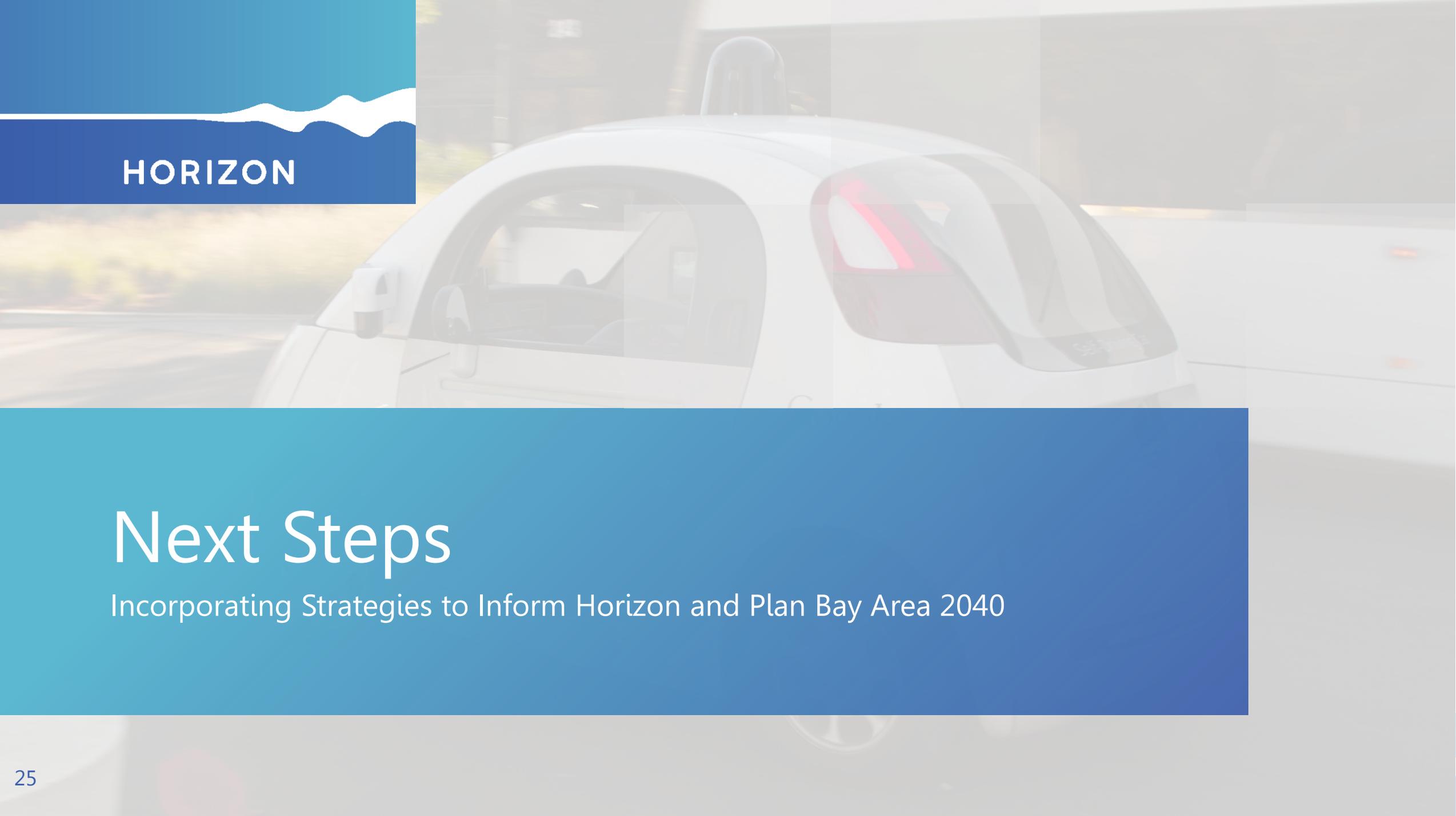
 **Connected**

 **Healthy**

 **Vibrant**

 **Diverse**

				
<p>Housing Opportunity Sites</p>	<p>Fair Pricing & Autonomous Transit</p>	<p>Vision Zero 2.0</p>	<p>New Deal for Mobility</p>	<p>Equitable Outcomes</p>
<p>Increase affordable housing supply</p>	<p>Expand access to high quality transportation</p>	<p>Save lives and improve air quality</p>	<p>Expand prosperity and access to jobs</p>	<p>Hold mobility service providers accountable</p>



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Next Steps

Incorporating Strategies to Inform Horizon and Plan Bay Area 2040

Planning for an Uncertain Future



- This fall, the strategies advanced in the AV perspective paper will be incorporated across some or all futures, depending upon assumptions about AV penetration, sharing preferences, EV penetration, etc.
- We will identify a short-list of strategies most effective in multiple futures to carry forward into Plan Bay Area 2050.

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Thank you!