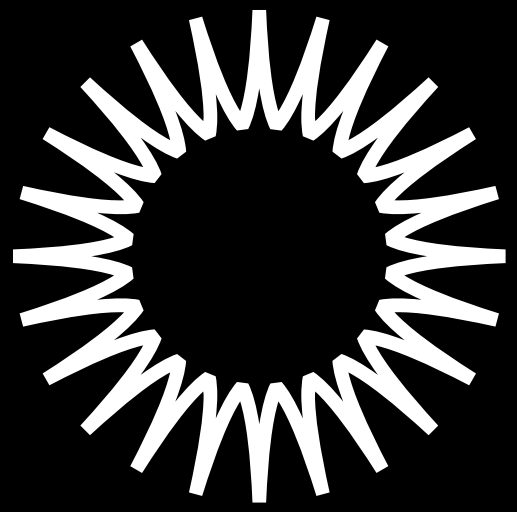

SPUR

Ideas + Action for a Better City

learn more at SPUR.org

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#FutureVehicles

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.

For more information, go to:

mtc.ca.gov/horizon

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

HORIZON

Futures Planning

Perspective Papers

Project Performance

PLAN BAY AREA 2050

HORIZON

Overview

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

HORIZON

HORIZON

Autonomous Vehicles 101

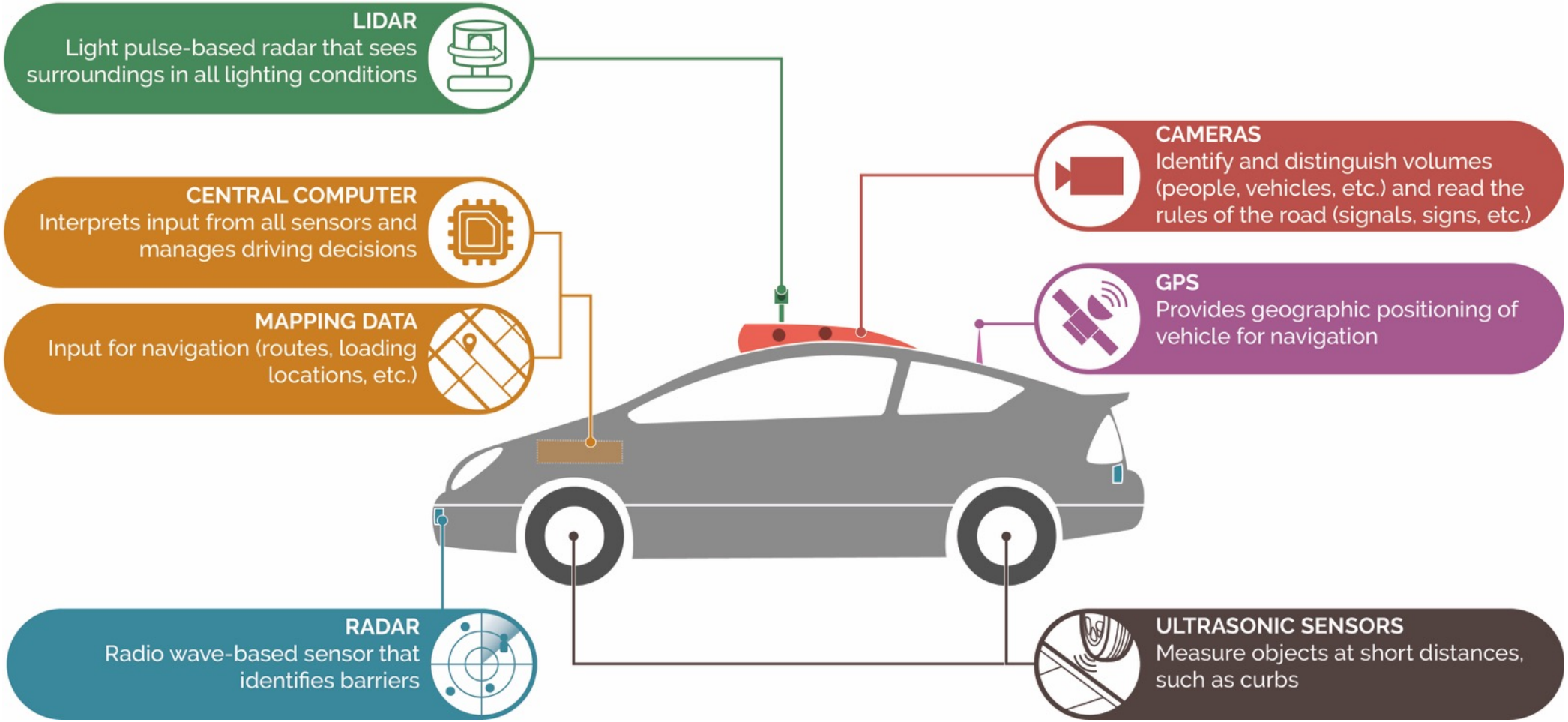
“Automated” versus “Connected”

AUTOMATED The increasing ability to drive without human assistance.

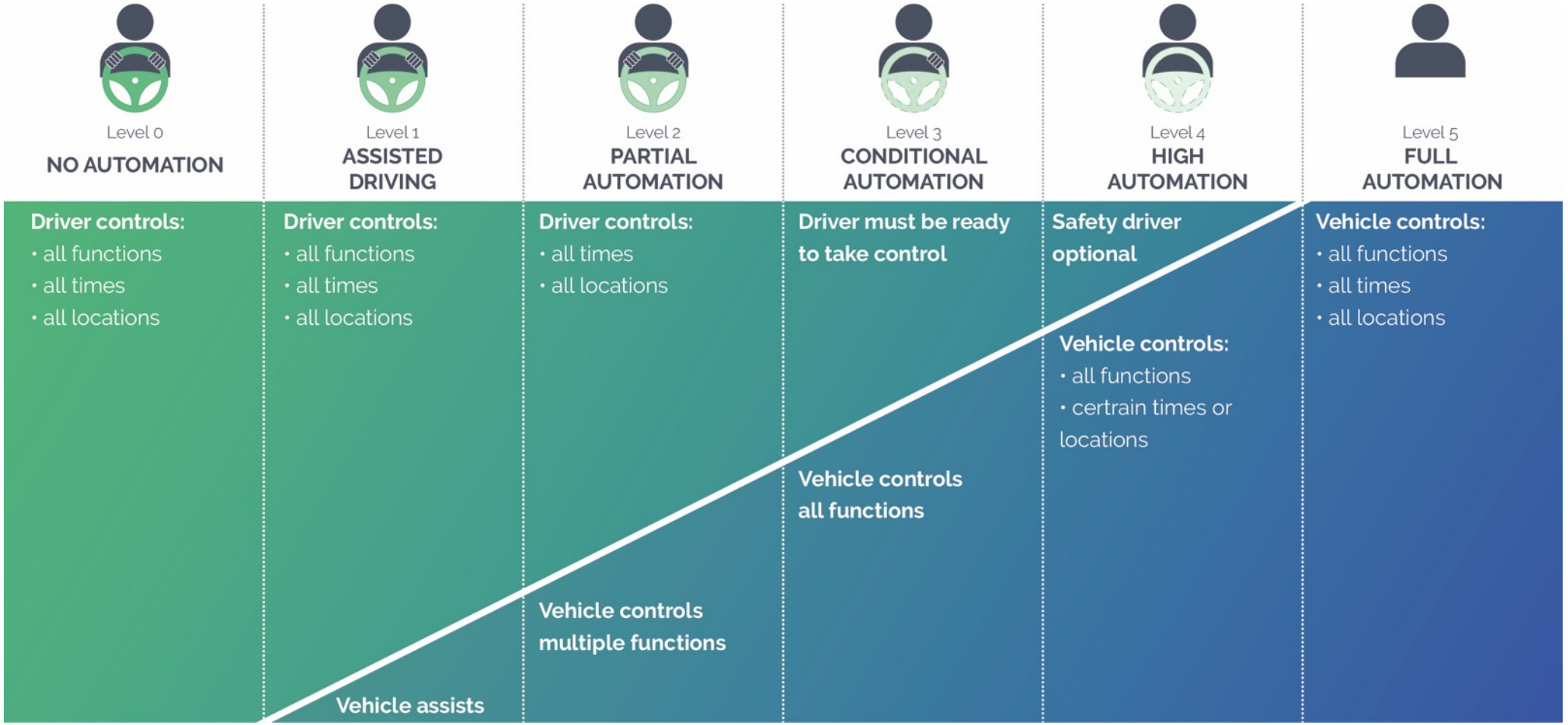
CONNECTED The increasing ability to share mobility or safety information among other vehicles, infrastructure, systems, etc.

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

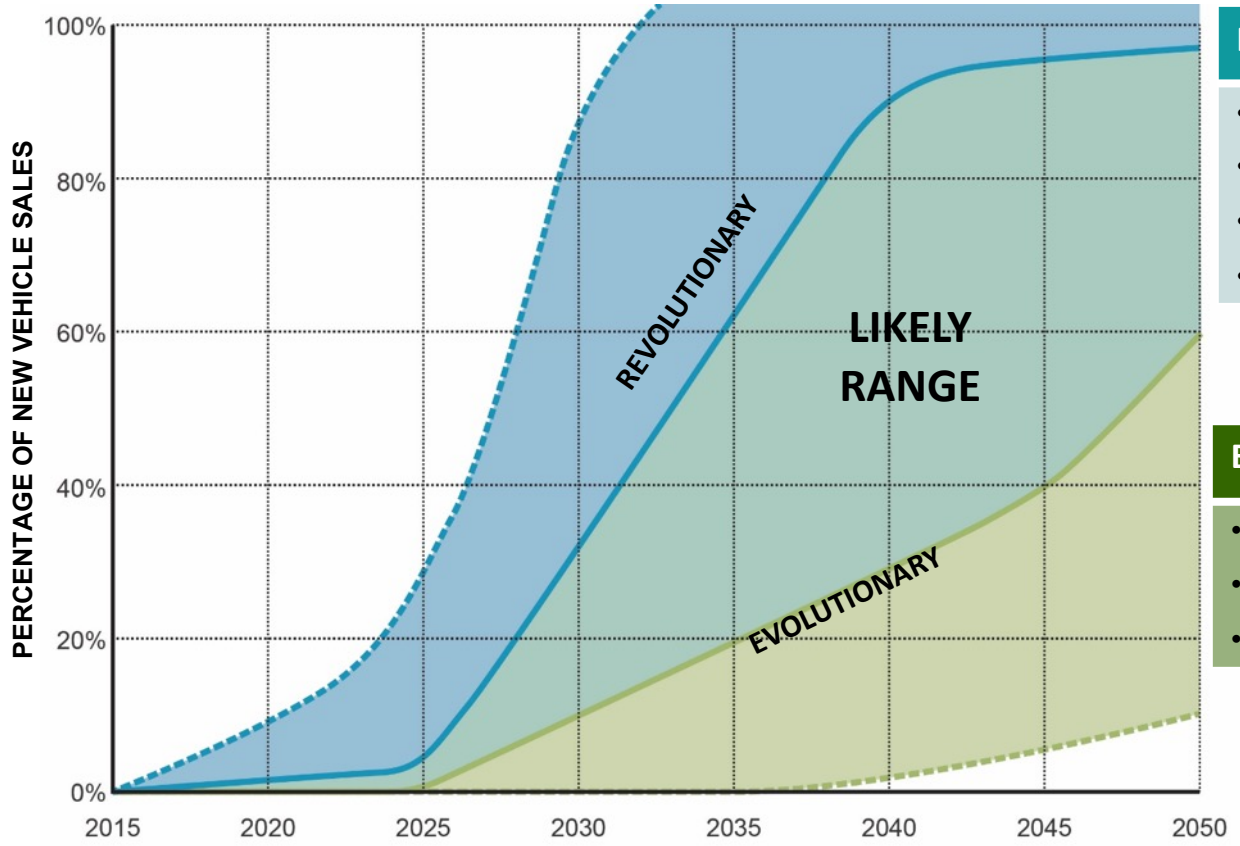
Autonomous Vehicles Components



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

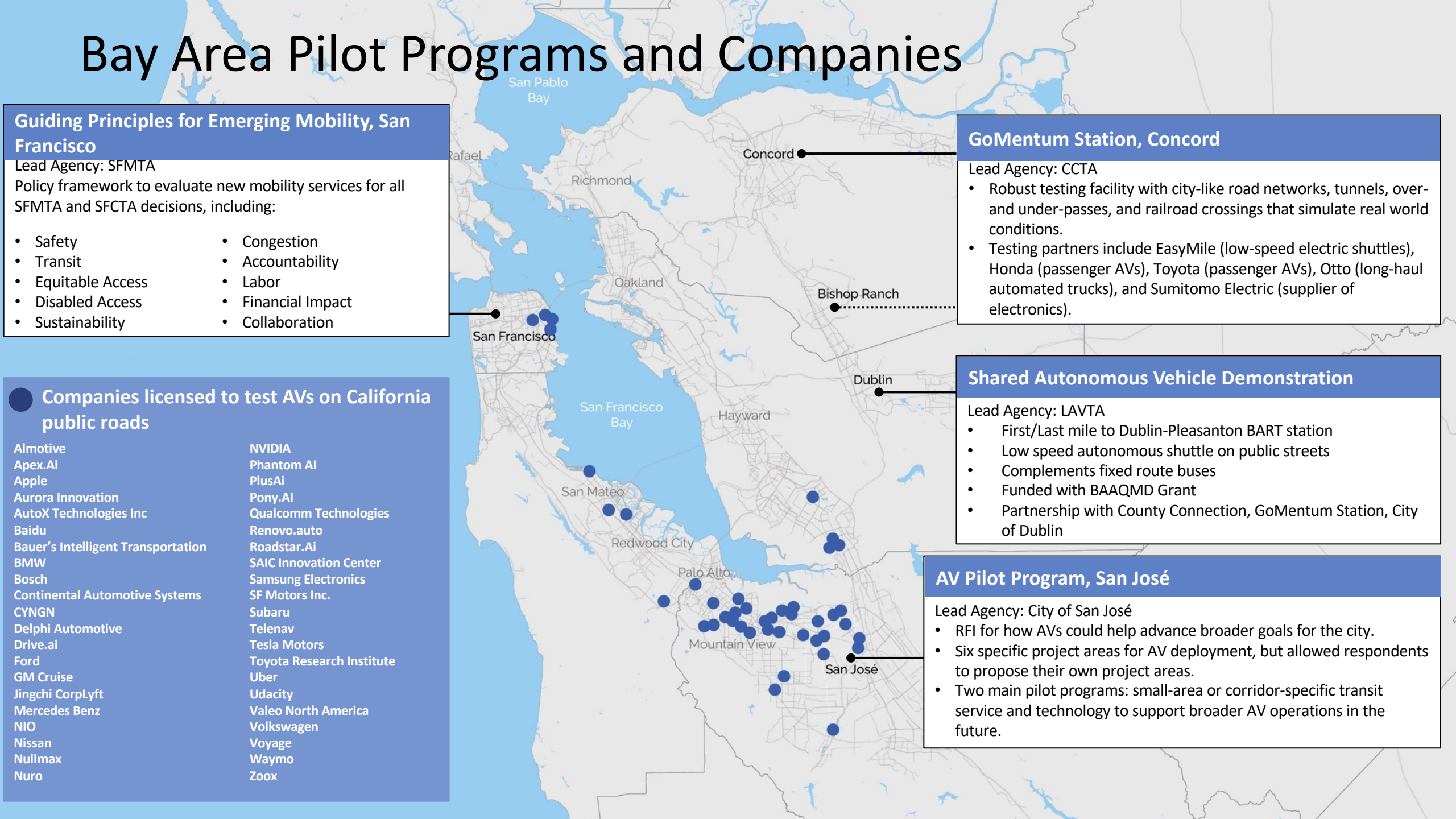
Lead Agency: LAVTA

- 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.



HORIZON

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.

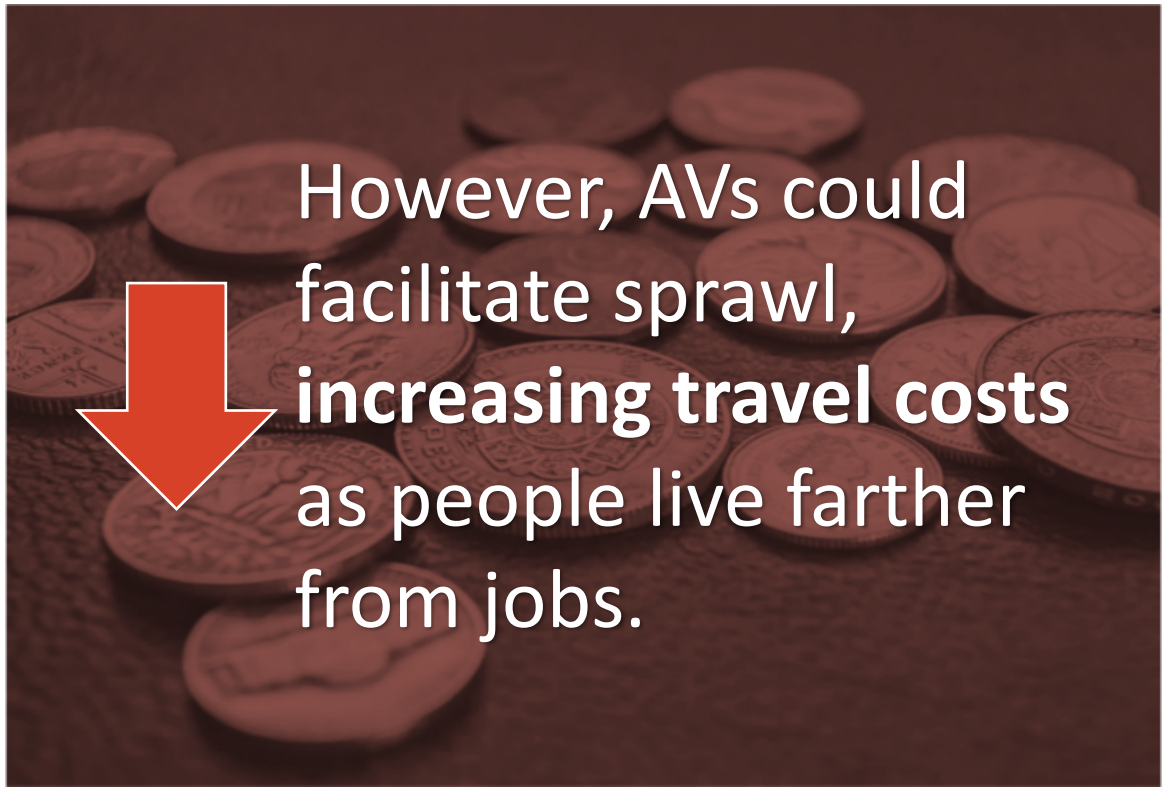
VIBRANT

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

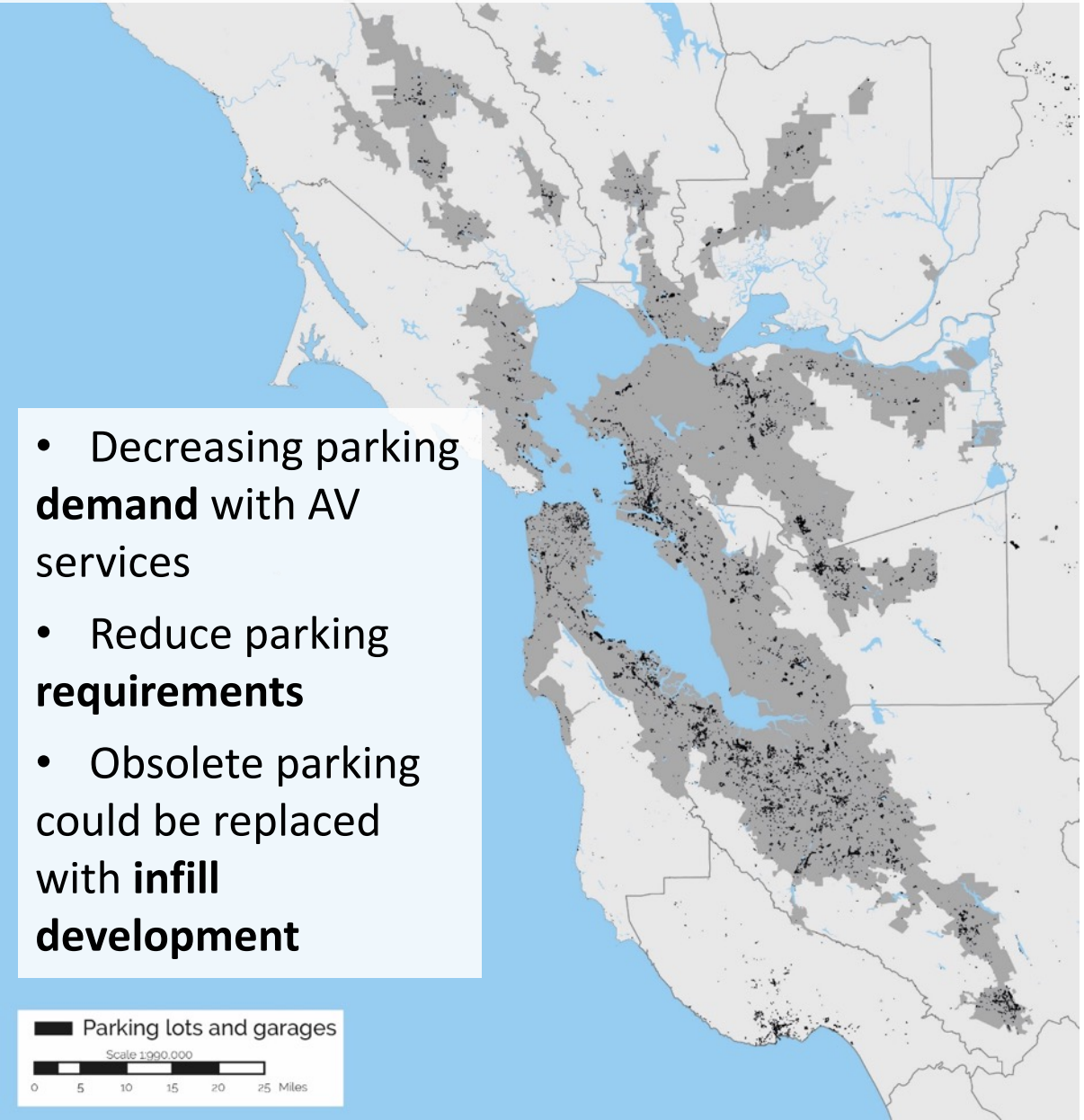
Icons Credit: The Noun Project

AFFORDABLE

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



Housing Opportunity Sites in an Autonomous Future



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

AFFORDABLE

Priority Strategies

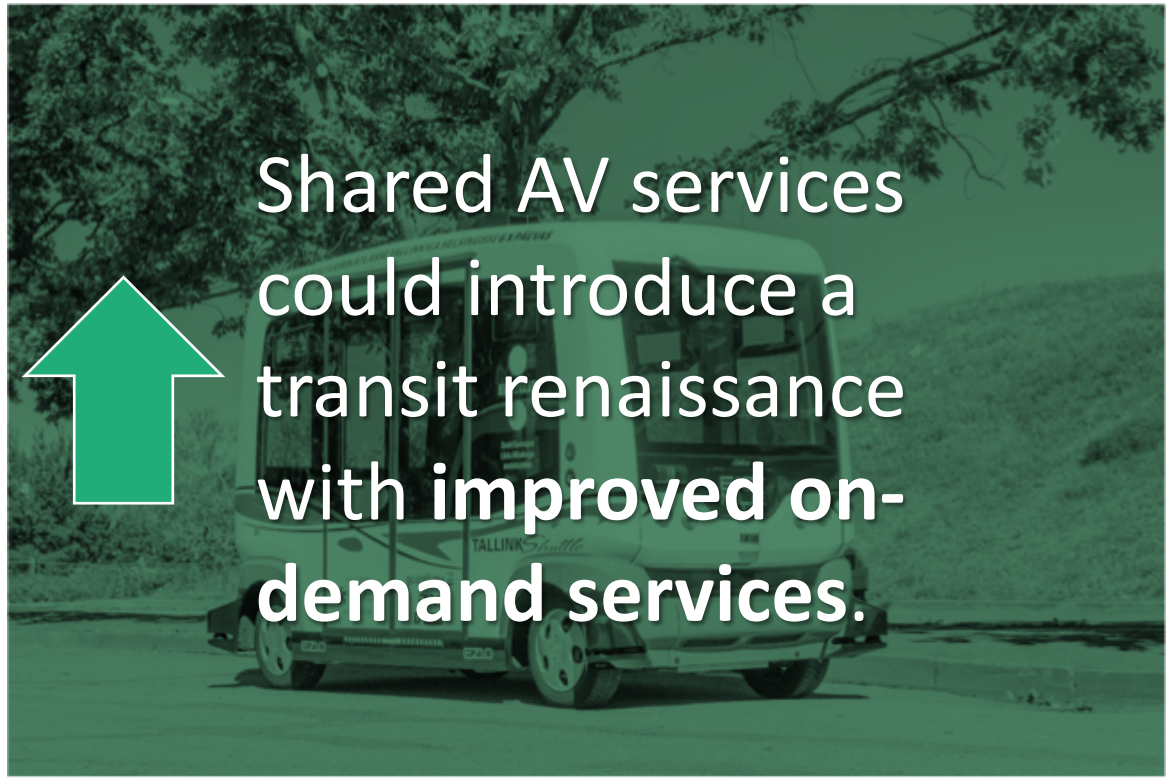
Repurpose off-street parking for **infill development**

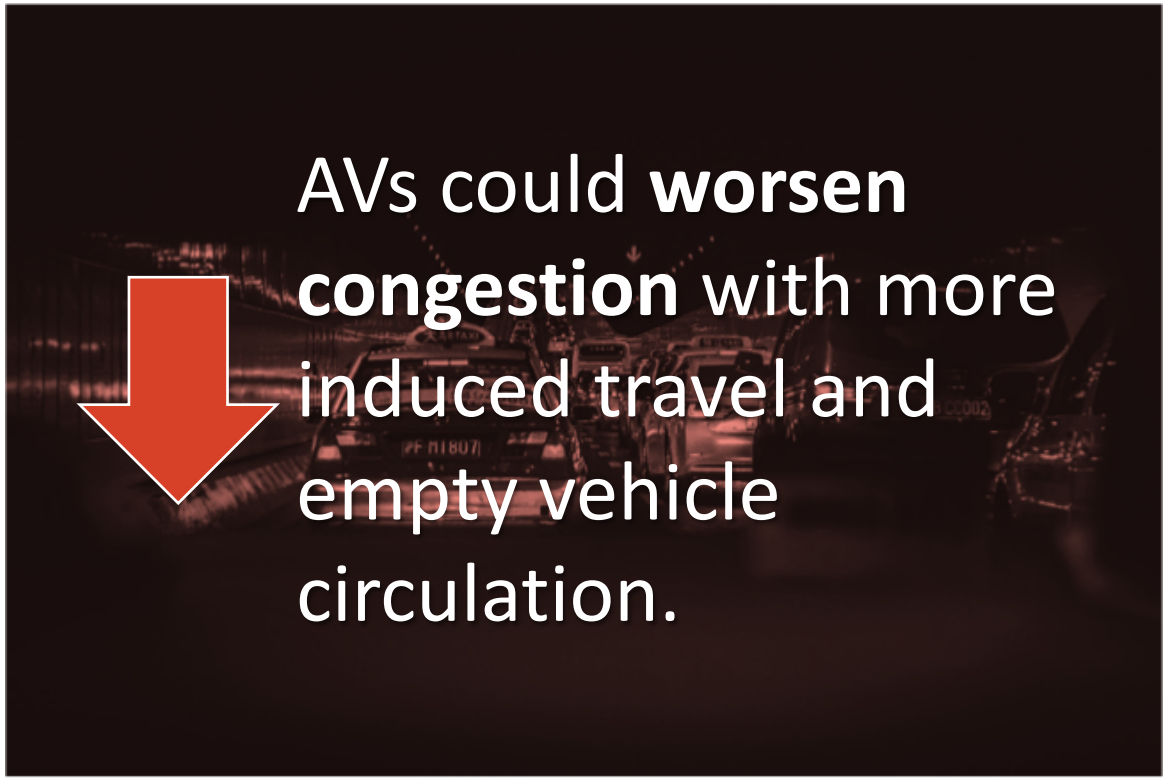
Institute **parking maximums** for both on- and off-street parking supply

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

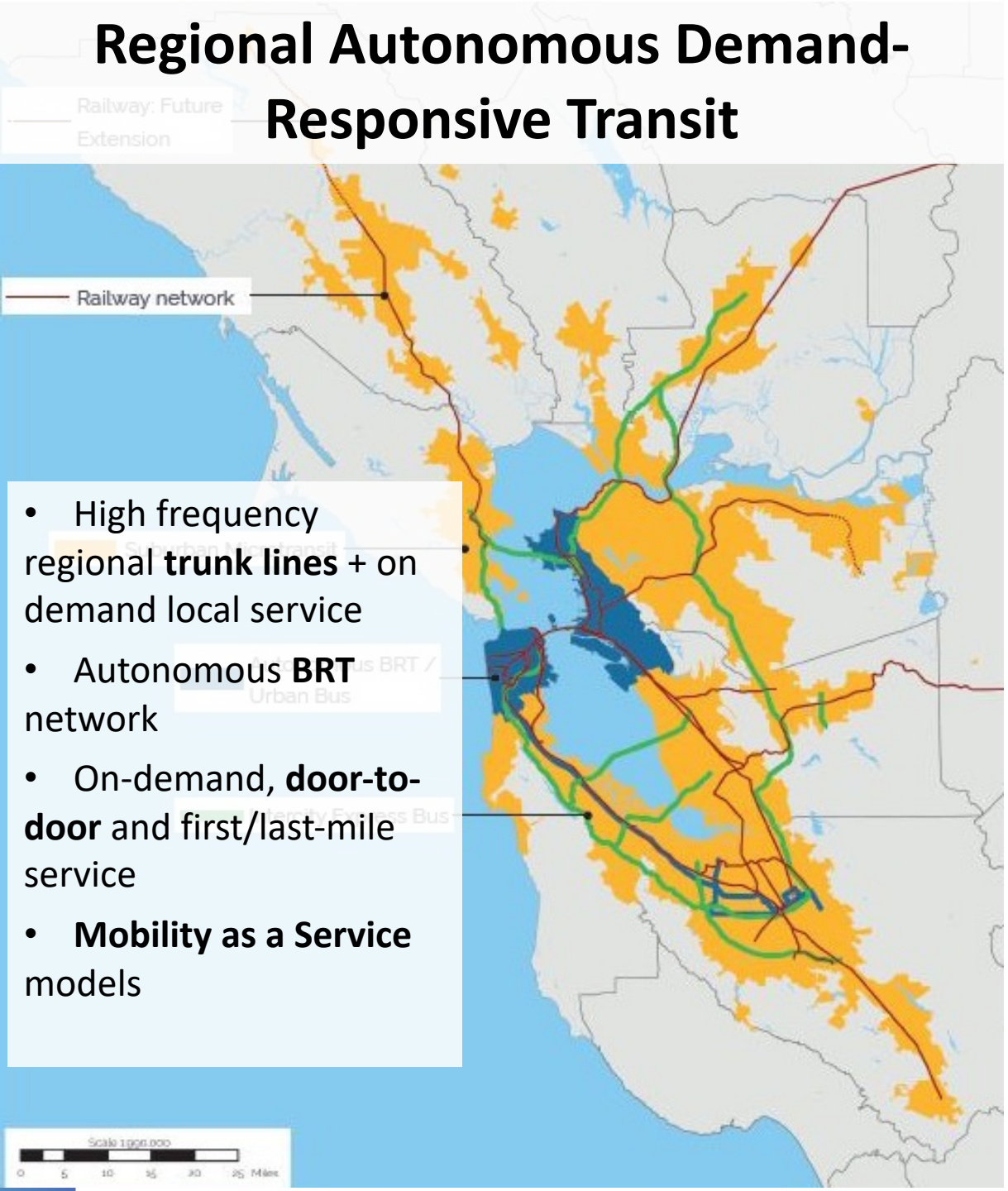
HORIZON

Horizon Guiding Principle – 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.





Regional Autonomous Demand-Responsive Transit



- 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

CONNECTED

Priority Strategies

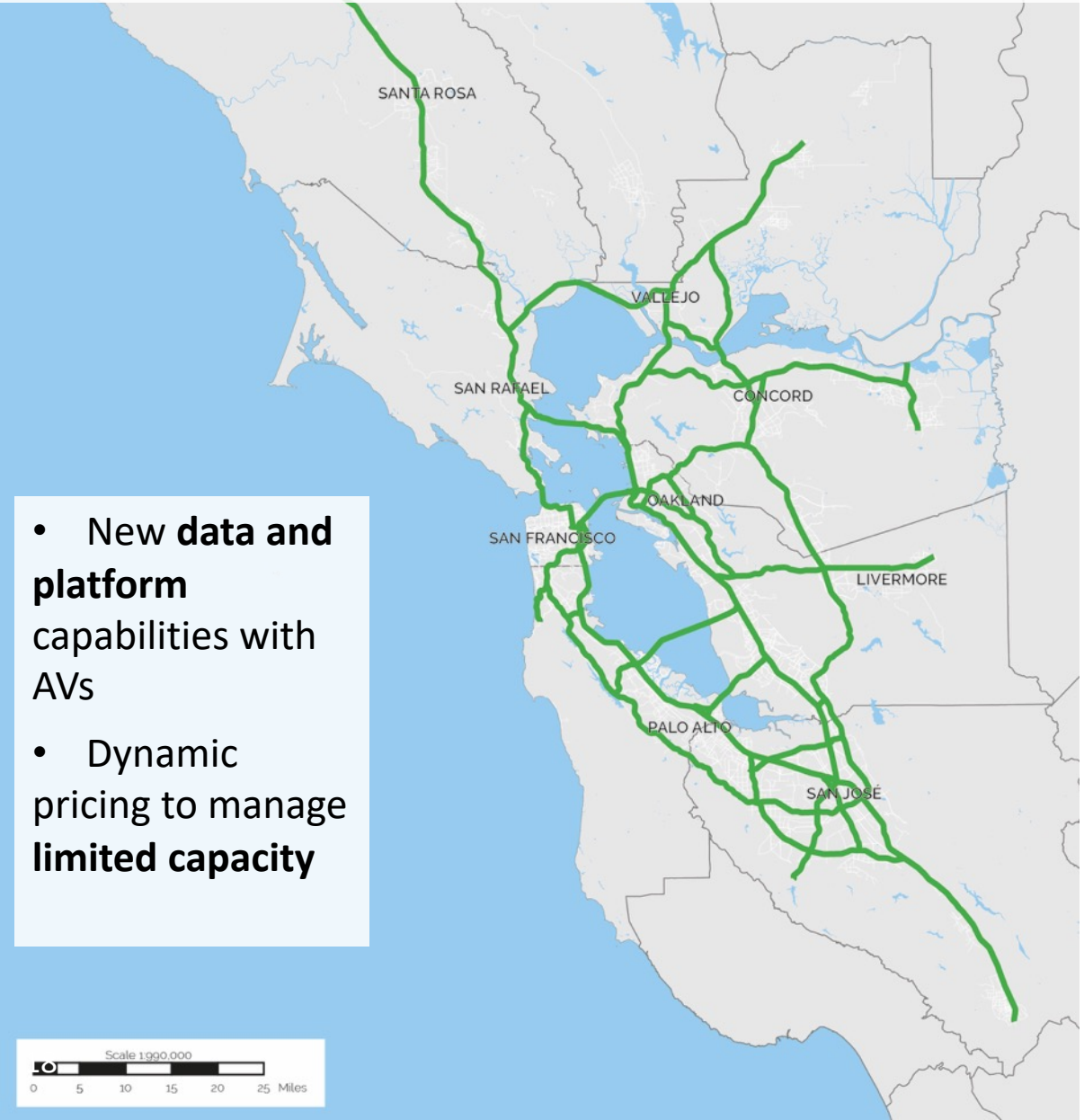
Double down on **high-capacity bus and rail corridors**

Innovate suburban transit with autonomous, **demand-responsive microtransit**

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

HORIZON

Dynamic Pricing Opportunities in an AV Future



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

CONNECTED

Priority Strategies

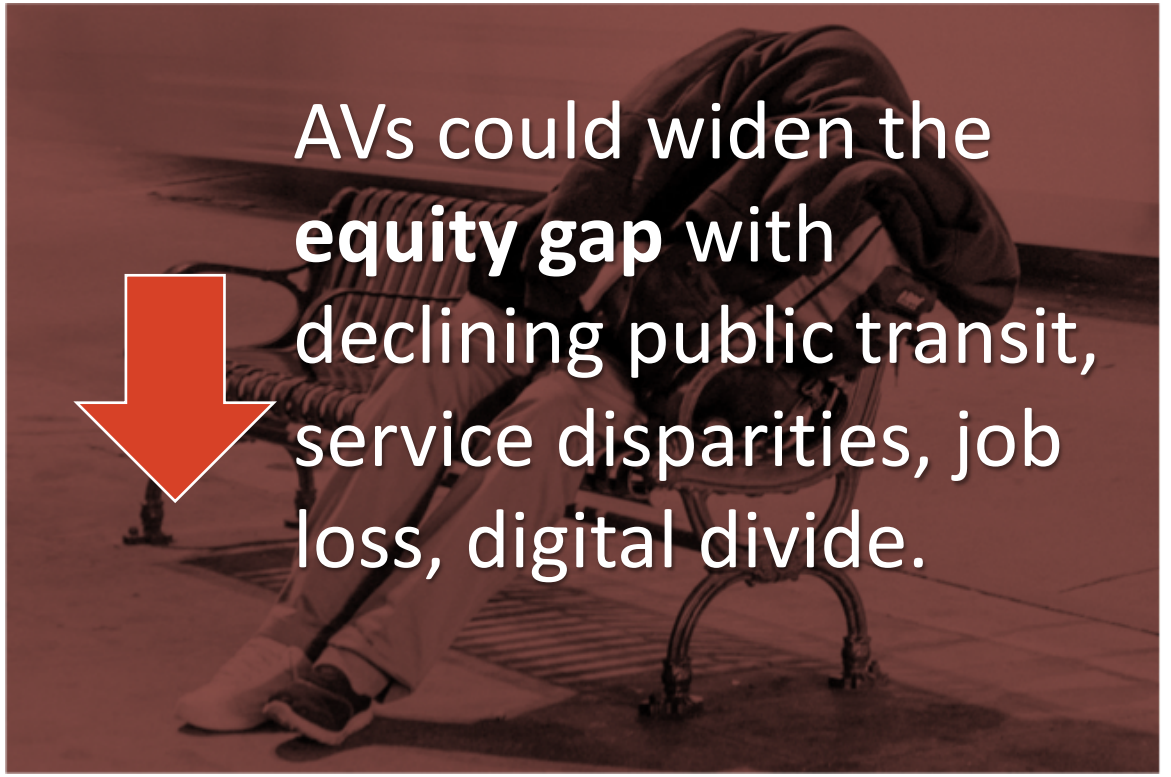
Price mobility fairly through **dynamic road pricing**

Design **smart streets** with dynamic allocation of street and curb space

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

HORIZON

Horizon Guiding Principle – 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.



Equitable AV Services

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

DIVERSE

Priority Strategies

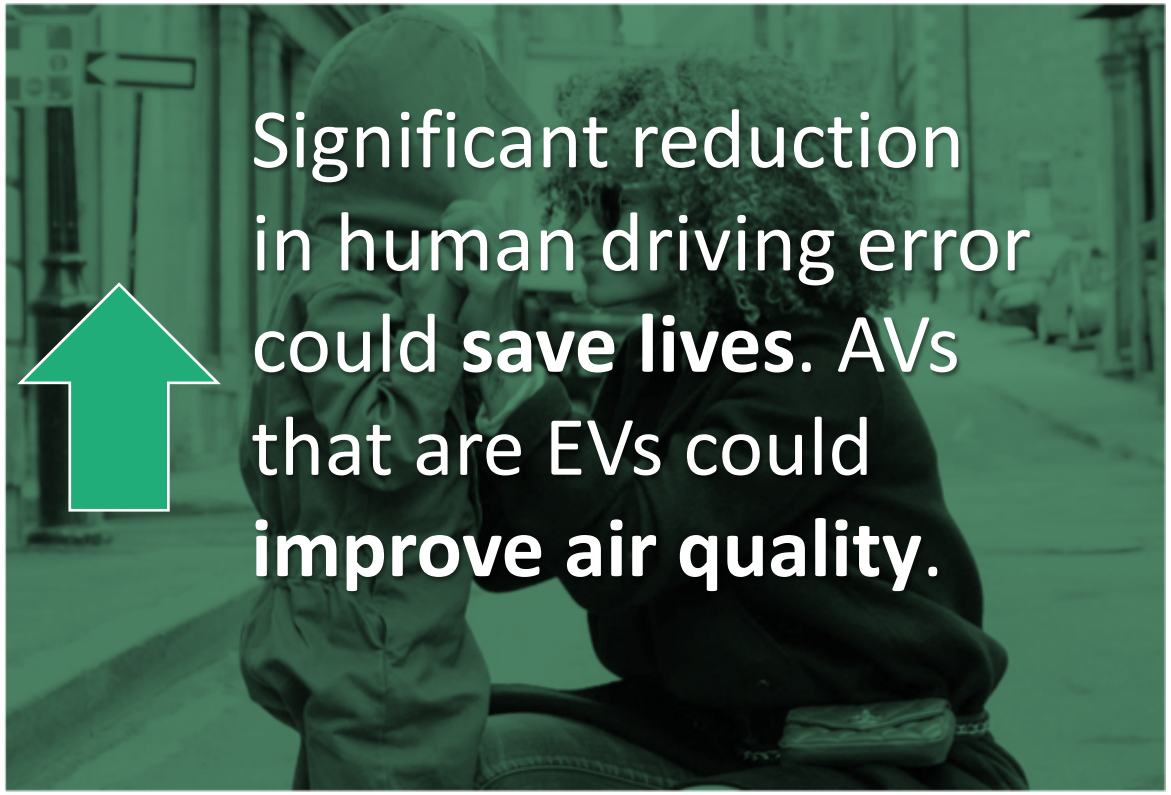
Mandate **equitable provision** of mobility services with transparent reporting

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

Prioritize **AV mobility services or programs** that serve Communities of Concern

HORIZON

Horizon Guiding Principle – 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.



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

Vision Zero 2.0

- **Eliminate** traffic-related deaths
- Nullify **cybersecurity** vulnerabilities
- Improve **air quality**
- Reduce transportation-related **public health** issues

HEALTHY

Priority Strategies

Cap **speed limits** in downtowns and neighborhoods

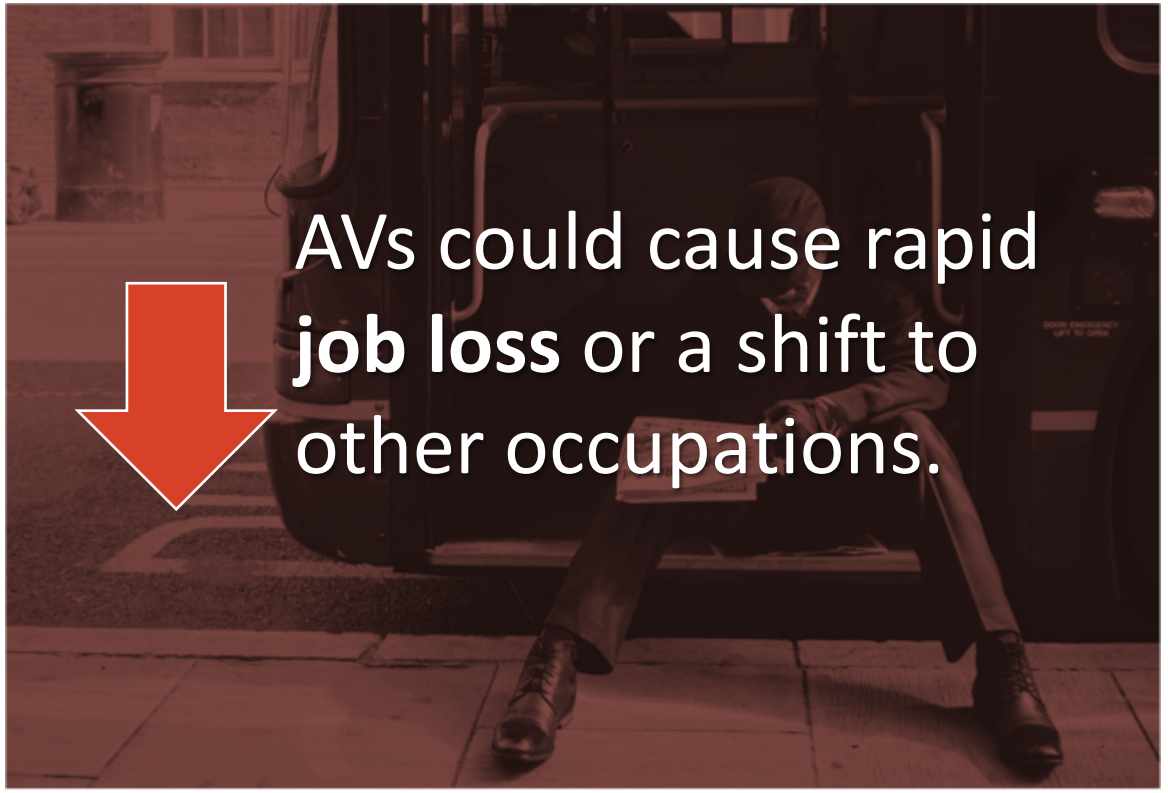
Mandate that **all AVs are EVs** and invest in the necessary infrastructure

Develop “bounty program” to reduce **hacking vulnerability**

HORIZON

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

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



“New Deal” for Mobility

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

VIBRANT

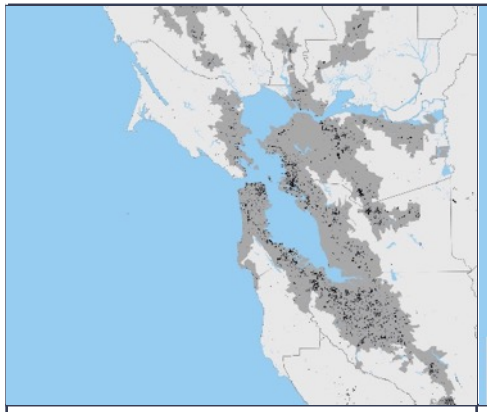
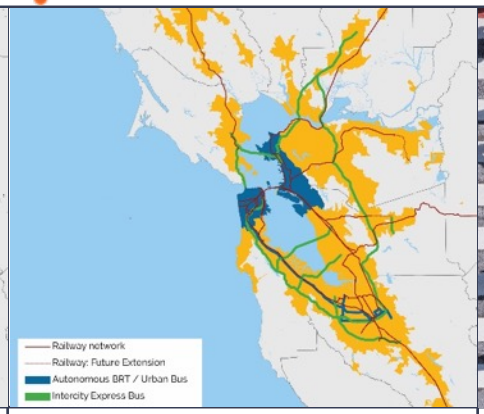
Priority Strategies

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

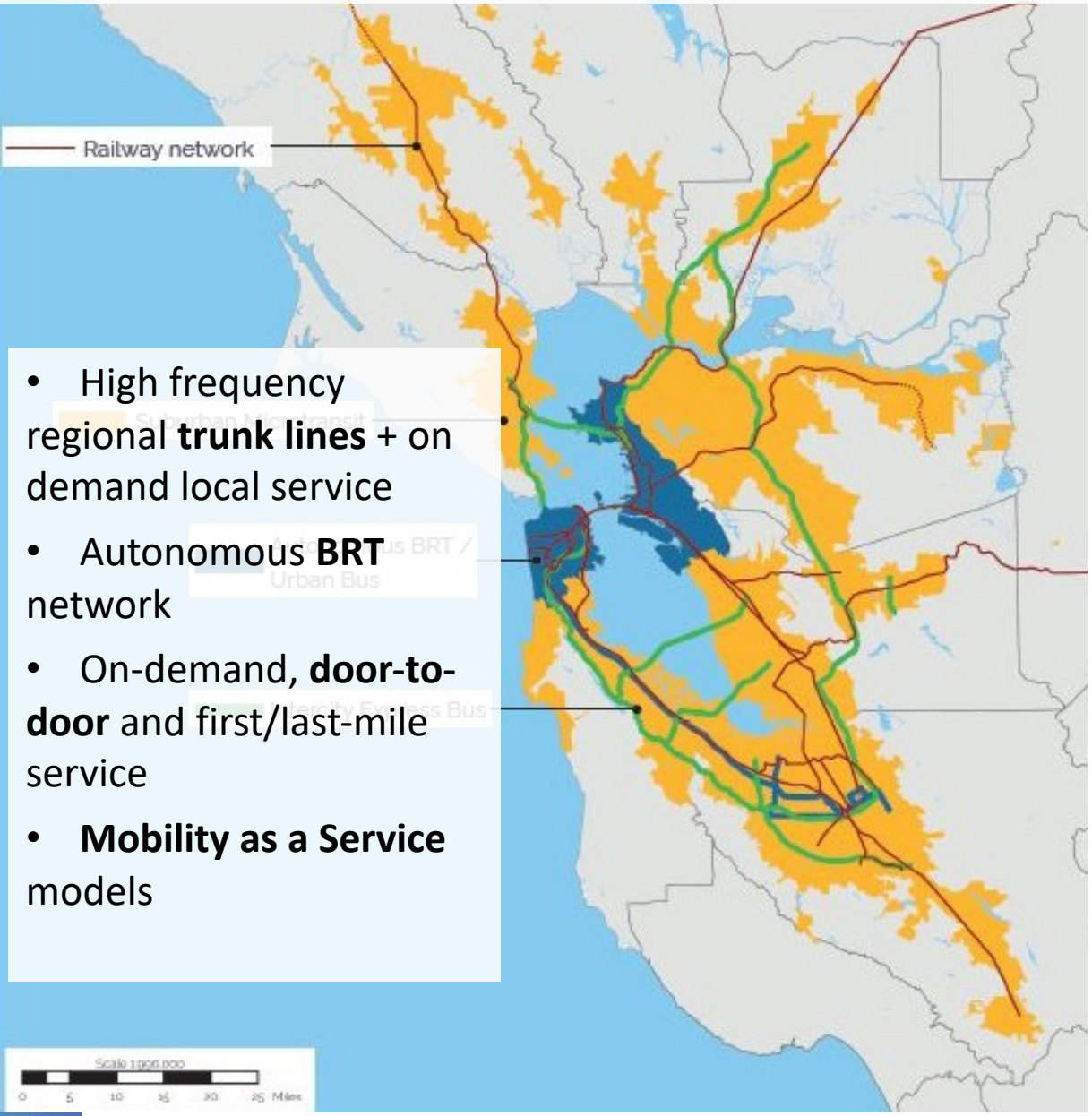
HORIZON

Affordable	Connected	Diverse	Healthy	Vibrant
				
Housing Opportunity Sites	**Fair Pricing & Autonomous Transit**	**Equitable Outcomes**	**Vision Zero 2.0**	**New Deal for Mobility**
Increase affordable housing supply	Expand access to high quality transportation	Ensure universal access to AV services	Save lives and improve air quality	Expand prosperity and access to jobs

HORIZON

Example Application

Regional Autonomous Demand-Responsive Transit



- 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

CONNECTED

Example Application

existing **high-capacity bus and rail corridors**

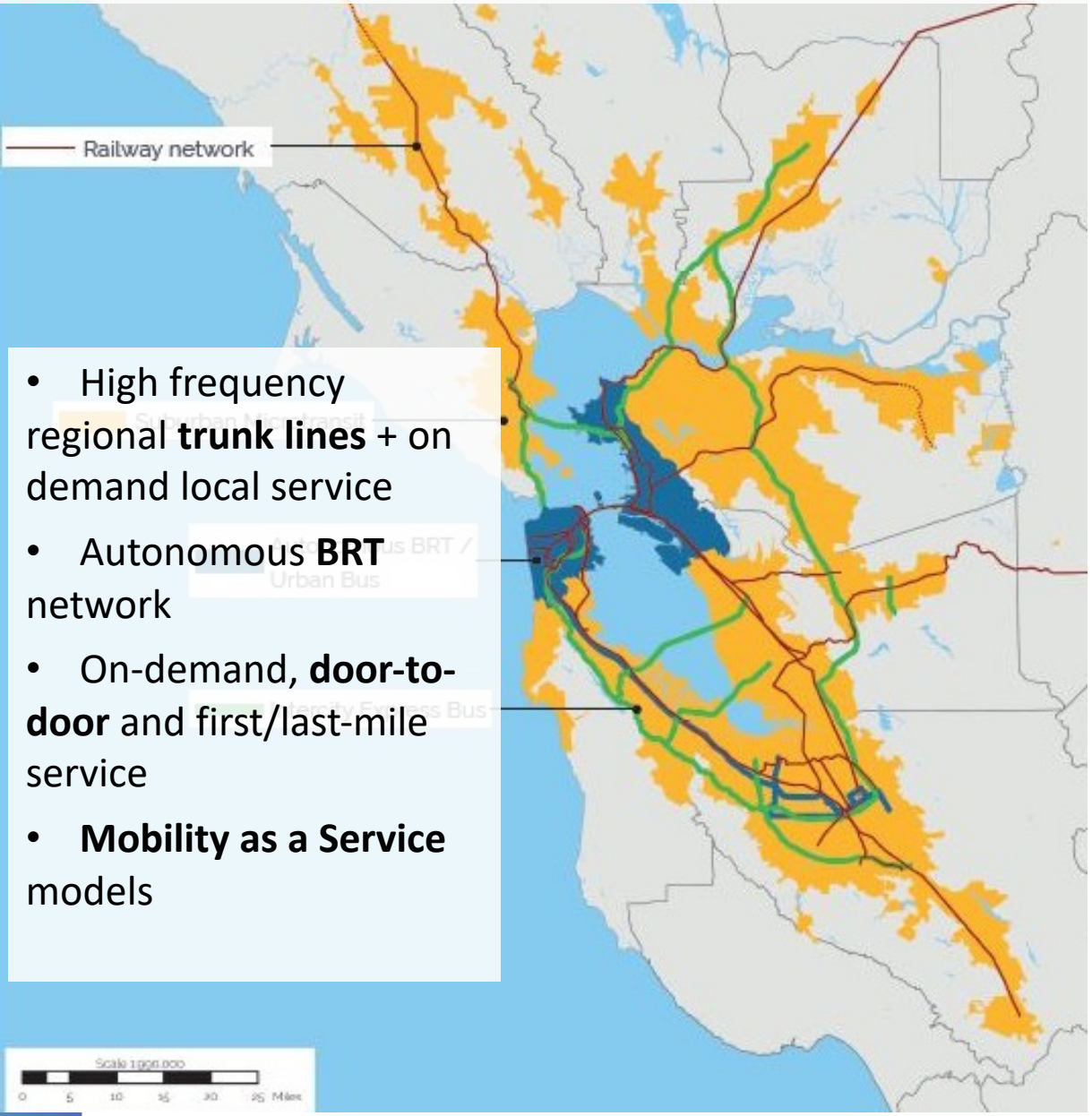
Higher frequency and higher speeds, resulting in travel times at least as fast as individual automobile trips.

Average service frequencies of at least 5 minutes, service spans exceeding 20 hours of service per day, on time performance of 95% or better.

The addition of 60’ articulated buses, or potentially double-deck buses to provide sufficient capacity on high-demand corridors. Other routes might be better served by operating traditional 40’ buses at higher frequencies.

HORIZON

Regional Autonomous Demand-Responsive Transit



- 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

CONNECTED

Example Application

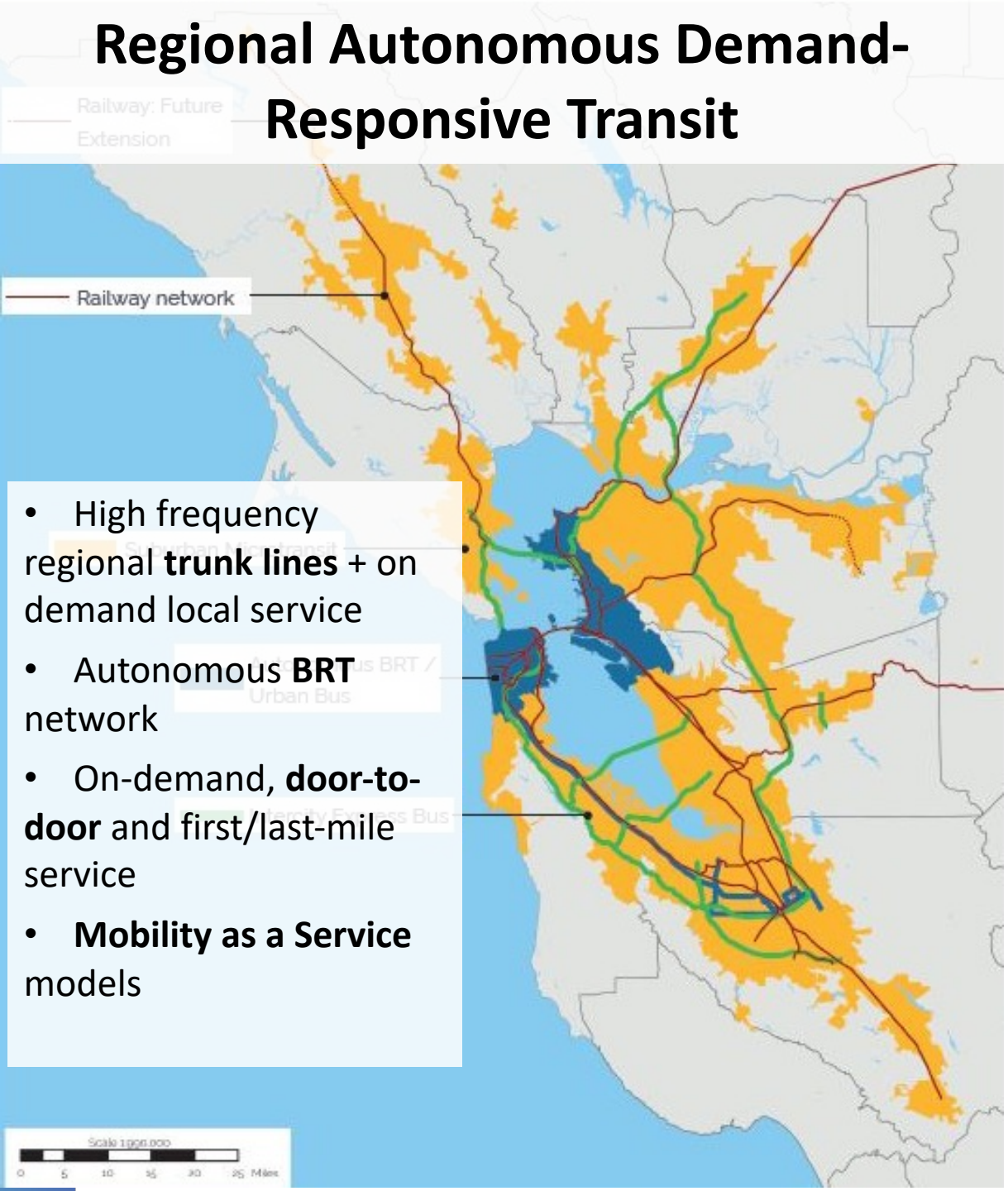
new **high-capacity bus and rail corridors**

Express bus networks on major highway corridors. Provide direct highway access, stations should be highway adjacent and preferable in-line, and land uses should support these emerging transit hubs.

Service frequencies of at least every 10 minutes, spans of service exceeding 15 hours of service per day, on-time performance of 95% or better, and travel time that is equal or superior to the autonomous vehicle.

Autonomous BRT should operate on major arterial streets in relatively high-density corridors with exclusive rights-of-way.

Regional Autonomous Demand-Responsive Transit



- 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

CONNECTED

Example Application

demand-responsive transit

Replace fixed-route bus services with demand-responsive service operated by either private or public entities and generally operating with smaller vehicles than traditional 40’ buses.

Candidate locations will have relatively low performance fixed routes.

Criteria include routes with:

- Farebox recovery less than 50% and
- Operating cost per rider greater than $10/ride.

HORIZON

mtc.ca.gov/horizon/perspective-papers

What's Next?

Incorporating Autonomous Vehicles Strategies into Futures Planning

Under which conditions do these priority strategies for autonomous vehicles make the most sense?

Three Futures – "What If?" Scenarios

A

Clean and Green

What if... new technologies and a national carbon tax enabled greater telecommuting and distributed job centers?

B

Rising Tides, Falling Fortunes

What if... the federal government cuts spending and reduces regulations, leaving more policy decisions to states and regions?

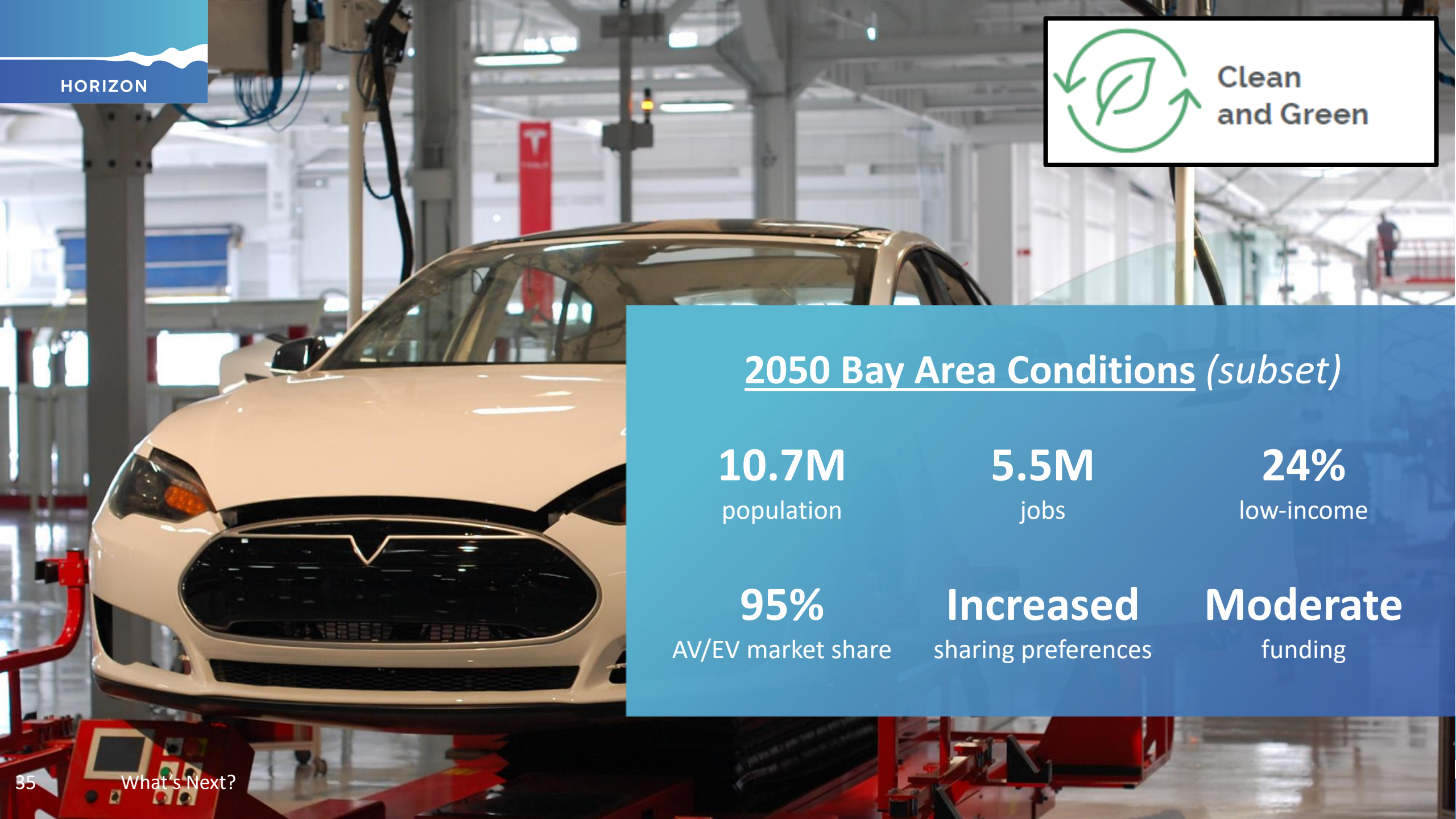
C

Back to the Future

What if... an economic boom and new transportation options spur a new wave of development?

Clean and Green

Recognizing the growing impacts of climate change, the federal government significantly tightens environmental regulations and implements an **ambitious, nationwide carbon tax**. New technologies thrive, with **virtual reality enabling telecommuting** and **smaller-scale workplaces** distributed across town centers. While high-tech manufacturing thrives in the United States, **economic growth slows for other more energy-intensive sectors**.



Clean and Green

2050 Bay Area Conditions *(subset)*

10.7M population	**5.5M** jobs	**24%** low-income
95% AV/EV market share	**Increased** sharing preferences	**Moderate** funding

Rising Tides, Falling Fortunes

Nationwide tax cuts and spending caps result a significant reduction in federal infrastructure funding. Combined with autonomous vehicles failing to live up to the hype, **cities, regions, and states are forced to pay for much-needed traditional infrastructure** projects themselves. Lack of regulatory action on climate change worldwide results **in sea levels rising by three feet by 2050** – creating a new set of infrastructure needs in an era of slow growth.

Rising Tides, Falling Fortunes

2050 Bay Area Conditions *(subset)*

8.6M population	**4.3M** jobs	**31%** low-income
10% AV/EV market share	**No change** sharing preferences	**Limited** funding

Back to the Future

The U.S. experiences **continued prosperity** and renewed respect on the world stage, thanks to smart and strategic policy decisions on the national level. **Rapid job growth** means more people want to move to the U.S., and **increased public investment in infrastructure** makes the nation more attractive for businesses. **Silicon Valley technologies are dominant worldwide** in everything from cars to e-commerce. Wealthy Americans seek larger suburban homes and **many depend on new technologies (such as high-speed rail)** to access urban job centers.

Back to the Future

2050 Bay Area Conditions *(subset)*

13.6M population	**6.7M** jobs	**22%** low-income
75% AV/EV market share	**Reduced** sharing preferences	**Increased** funding

Aligning Specific Strategies with Futures

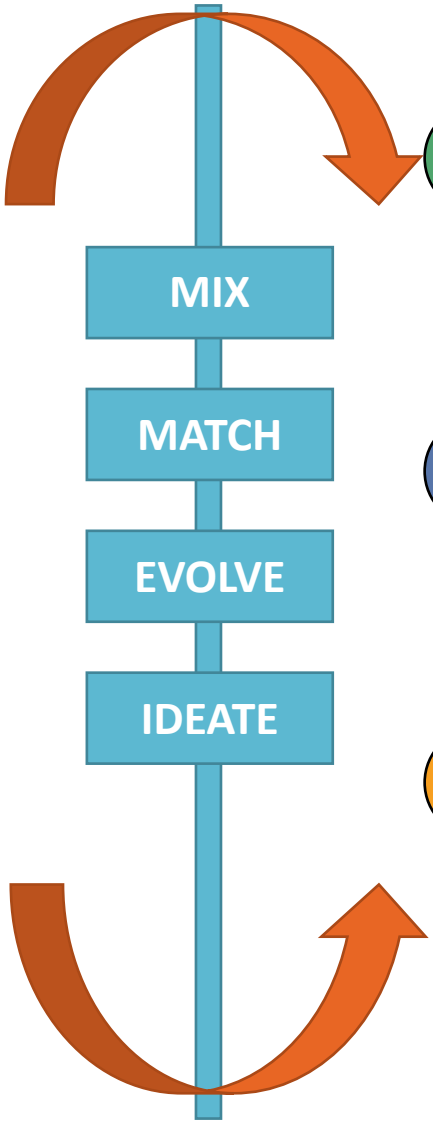
AFFORDABLE — Housing Opportunity Sites

CONNECTED — Fair Pricing & Autonomous Transit

DIVERSE — Equitable Outcomes

HEALTHY — Vision Zero 2.0

VIBRANT — New Deal for Mobility



A — Clean and Green

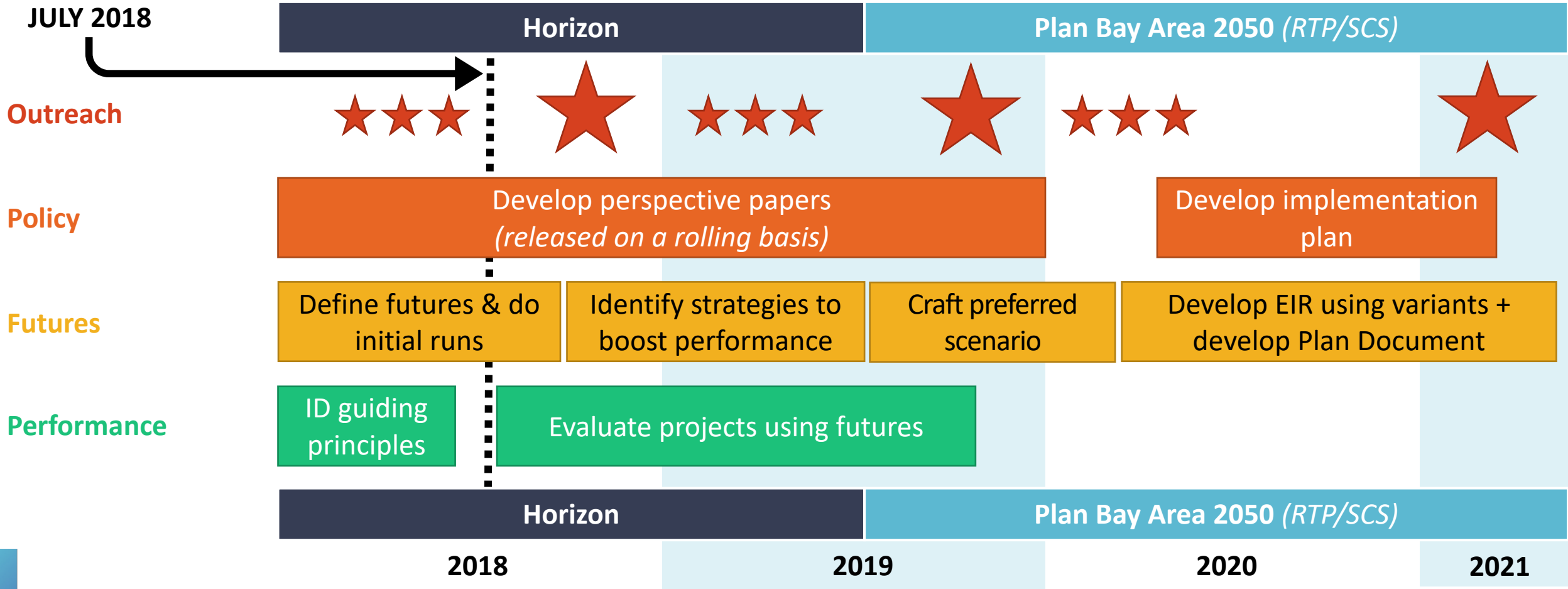
B — Rising Tides, Falling Fortunes

C — Back to the Future

Strategies Outreach (Fall 2018)

- Later this fall, we will be conducting **public and stakeholder outreach** to determine which strategies and investments would be **most effective** in improving outcomes in each future.
- Strategies will need to address opportunities and challenges in each future related to:
  - **Transportation (including Autonomous Vehicles)**
  - **Land Use/Housing**
  - **Economic Development**
  - **Resilience**
- We will then analyze how effective these strategies and investments are in aligning outcomes in each future more closely with the Guiding Principles, **culminating in a final report in mid-2019.**

Horizon + Plan Bay Area 2050 Schedule



HORIZON

Questions?

Comments?

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Thank you!

mtc.ca.gov/horizon