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California Transportation Plan 2050

Public Review Draft

For Public Review

August 2020





The draft CTP 2050 was prepared by the California Department of Transportation (Caltrans)
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This document is considered a draft until final approval.

CALIFORNIA TRANSPORTATION PLAN 2050



Public Review Draft

August 2020



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EXECUTIVE SUMMARY

California's transportation system exists to serve its people and their communities. It connects California's nearly 40 million residents to jobs, housing, services, and recreation; and facilitates trade to and from the world's 5th largest economy. But transportation does far more than connect people and goods to their destinations; it plays a central role in our economic opportunities, cost of living, environmental quality, health, and quality of life.

California's population and geography are incredibly diverse. It is home to some of the nation's most populous metropolitan areas, as well as a vast landscape of coastal, mountain, agricultural, and Tribal communities, each of which faces unique transportation needs and challenges. By 2050, California will be home to six million new residents. Approximately a quarter of the population will be over 65, and we will have become even more racially and ethnically diverse.¹ These and other changes will impact where people live, their preferred modes of travel, and the transportation options they require to meet evolving needs and preferences.

Over the past two and a half years, hundreds of Californians representing a diverse cross-section of backgrounds, regions, and interests have come together to lay out their vision for a transportation system that reflects our collective values as a state. They imagine a **safe, resilient, and universally accessible transportation system that supports vibrant communities, advances racial and economic justice, and improves public and environmental health**. The California Transportation Plan (CTP) 2050 is our roadmap for achieving this vision through people-focused policies, strategies, and investments that will improve the lives of all Californians.

A CALL TO ACTION

The CTP 2050 comes at a critical moment in our history, as California struggles to address the damage caused by two destructive forces: the COVID-19 pandemic of 2020 and systemic racial injustice. The arrival of COVID-19 in early 2020 tragically claimed the lives of thousands of Californians, drove

What is the CTP 2050?

The CTP 2050 is a roadmap for positive change that:

- ▶ Provides a unifying and foundational policy framework for making effective, transparent, and transformational transportation decisions in California;
- ▶ Addresses the varied transportation needs of urban, suburban, rural, and Tribal communities; and
- ▶ Emphasizes implementation and identifies a timeline, roles, and responsibilities for each plan recommendation.

state unemployment to 25 percent², and pulled the country into economic recession. The way we live, work, and travel was abruptly transformed. Stay-at-home policies aimed at preventing the spread of the virus ushered in widespread telework, online shopping, and distance learning; while disruptions to supply chains and demand for home deliveries shocked our freight system. A safe and healthy path toward economic recovery must be California's top priority, but we must not lose sight of our long-term vision. While COVID-19 virtually eliminated roadway congestion in many cities, vehicle traffic will return as the economy recovers, and may worsen if Californians continue to avoid transit and other shared modes for fear of virus exposure. Managing congestion and expanding transit were priorities before the arrival of COVID-19, and remain essential to achieving a sustainable recovery. This plan seeks to advance the invaluable work of California's regional and local agencies, by offering statewide guidance and leadership to aid in our immediate recovery, and to build more healthy and resilient communities in the years to come.

Amid COVID-19 and the following economic recession, the nation is also experiencing widespread protests against ongoing racial injustice in all aspects of American society. This plan acknowledges the role that transportation has played in creating and perpetuating these injustices. For far too long, transportation decisions have divided communities through redlining, urban highway development, gentrification and redevelopment, and outright discrimination. These decisions have amplified racial inequities by heightening exposure to air pollution in Black and Brown communities and limiting access to jobs, housing, health care, education, and mobility options. These factors have all contributed to people of color being hit hardest by the COVID-19 pandemic and economic recession. This plan seeks to advance racial and economic justice by redirecting resources to marginalized communities; better connecting individuals to jobs, health care, education, and other opportunities; improving environmental justice; and amplifying the voices of those who have been historically excluded from the transportation decision-making process.

While the CTP 2050 is committed to addressing the immediate threats of COVID-19, and long-standing systemic injustice, it also reinforces California's firm commitment to combatting climate change and the many risks it poses to our infrastructure and communities. The CTP 2050 is required to show how California can reduce transportation sector greenhouse gas (GHG) emissions to 80 percent below 1990 levels by 2050, and support numerous other pieces of ambitious climate legislation.¹ This plan demonstrates how advancements in clean fuel technologies; continued shifts toward active travel, transit, and shared mobility; more efficient land use and development practices; and continued shifts to telework, can collectively reduce transportation emissions to support these goals. As it addresses these efforts, the CTP 2050 also reinforces long-held values such as improving system safety, improving mobility and accessibility, advancing environmental health and justice, and enhancing quality of life.

Though California faces many difficult challenges today, there is ample opportunity for positive change on the horizon. We have unprecedented access to technological innovation, transformative policies, and the collective determination required to address our challenges. The CTP identifies 14 recommendations that, if implemented, can help California achieve our bold vision for 2050. While each of these strategies together will be necessary to

¹ In addition to SB 391, notable California climate legislation includes Executive Order (EO) B-55-18 requiring carbon-neutrality by 2045, SB 100 requiring 100 percent clean energy by 2045, and EO N-19-19 requiring California to redouble efforts to reduce GHG emissions.

meet long-term goals, the short-term focus remains on addressing California's most immediate needs, including recovery from the COVID-19 pandemic, advancing racial and economic justice, and improved transportation system resilience.

Successful implementation of this plan will require the sustained commitment and cooperation of the California Department of Transportation (Caltrans) and other State agencies, and the visionary leadership of local and regional partners. By working together across regions and jurisdictional boundaries to implement this plan's recommendations, we have the power to achieve our collective transportation vision.

THE CTP 2050 VISION

The CTP 2050 is guided by a unified, forward-looking vision for California's future transportation system that was developed with the input of hundreds of stakeholders from all corners of the state:

“California’s safe, resilient, and universally accessible transportation system supports vibrant communities, advances racial and economic justice, and improves public and environmental health.”

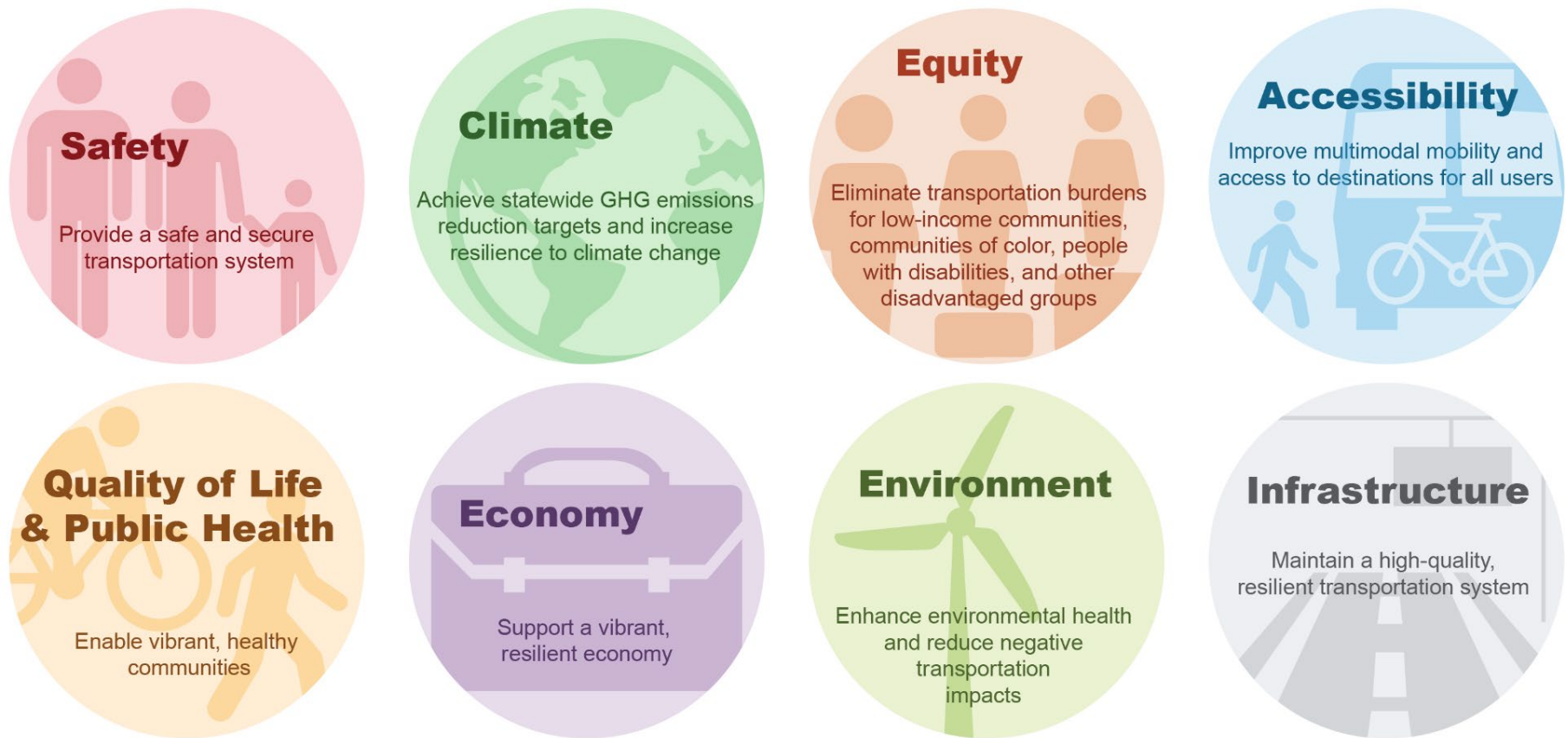
By 2050, California's transportation system will provide nearly 45 million residents with convenient and reliable access to jobs, education, health care, services, and more. It will offer a range of high-quality, safe, and affordable mobility options, connecting urban, rural, coastal, mountain, and inland regions into an integrated multimodal network. Urban centers such as Los Angeles, the San Francisco Bay Area, San Diego, and Sacramento, will build sufficient housing to meet demand. The majority of new housing will be built in transit-supportive areas and be affordable to low- and middle-income Californians, ensuring that residents have viable alternatives to the automobile, and that those who need to drive can do so amid minimal congestion. Rural and Tribal communities will enjoy greater access to jobs and goods through expanded mobility options and innovative technologies, while maintaining a rural way of life.

The 2050 transportation system will aim to reduce transportation-related fatalities and serious injuries to zero. It will be high-tech, high-quality, and

resilient to the impacts of climate change, earthquakes, pandemics, and other disruptions, ensuring protection of our invaluable natural and cultural resources. It will power the expansion and diversification of California's world-class economy, with a modernized and sustainable freight system that supports local economic growth. Our future transportation system will be carbon-neutral, enhancing public health and quality of life for all Californians, regardless of race, ethnicity, income, age, gender, sexual orientation, or ability. Our future system will advance quality of life and economic opportunity for people of color and low-income communities, who have long endured the greatest burdens of our transportation system, building economic opportunity and mobility for those who need it most.

To make this vision a reality, Californians have identified eight priority goal areas (Figure 1) to guide state and regional transportation planning and decision-making in the years ahead.

FIGURE 1 CTP 2050 GOALS



OUR PATH FORWARD

Through a combination of research, stakeholder input, and rigorous analysis, the CTP 2050 identifies 14 cross-cutting recommendations, which together address each of the goals identified in the CTP 2050 vision. These recommendations are summarized below, with specific action items to achieve each recommendation in Chapter 5.

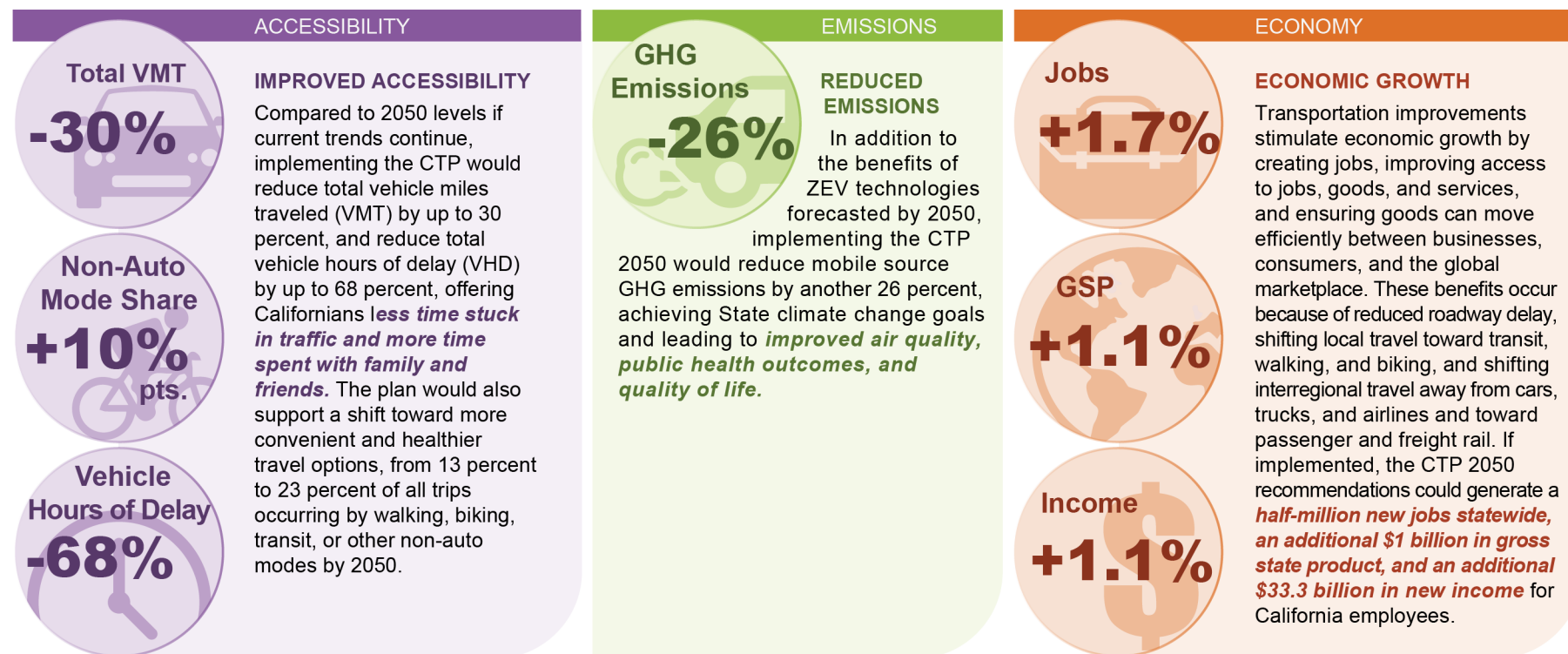
FIGURE 2 CTP 2050 RECOMMENDATIONS



PLAN BENEFITS

How much progress can we make toward achieving our goals if we implement the CTP 2050 recommendations? To answer this question, the CTP explored a quantitative analysis of future travel accessibility, emissions, and economic impacts, the results of which are presented in Figure 3.ⁱⁱ

FIGURE 3 CTP 2050 PLAN BENEFITS



Source: California Statewide Freight Forecasting and Travel Demand Model (CSF2TDM).

ⁱⁱ The technical analysis was performed before the onset of COVID-19, and therefore the benefits do not reflect immediate observed transportation impacts to congestion, transit, commuting, ridesharing, and more. As such, the plan benefits reflect transportation conditions if travel activity and California's economy recover and return to pre-COVID-19 levels by 2050. Additionally, it should be noted that these results reflect planned and programmed improvements at the state and regional level, as well as the CTP 2050 recommendations.

PLAN DEVELOPMENT

The development of the CTP 2050 is a multi-year effort involving cross-sector coordination with State, regional, and local partners, extensive research, public engagement, technical analysis, and oversight from multiple committees. The CTP 2050 builds on concurrent efforts included in Caltrans' six modal plans, regional transportation plans (RTP), other statewide plans and studies such as the 2017 Climate Change Scoping Plan, Strategic Highway Safety Plan, and Statewide Housing Assessment. It also draws from research on demographic shifts, technology trends, and economic growth to help inform where we are going as a state, what strategies we can employ, and what challenges and opportunities we may face along the way. To evaluate future conditions and plan benefits, the CTP 2050 employed a suite of technical tools and models to help inform policy-decision making.

The CTP 2050 development process is rooted in extensive public and stakeholder involvement. Through Tribal Listening Sessions, Visioning Sessions, and Stakeholder and Public Workshops, the CTP received broad input from public agencies, private organizations, and thousands of community members. The CTP 2050 was developed in close coordination with a range of committed stakeholder representatives, who provided strategic guidance and oversight of the planning process. This document complies with all State and Federal laws regarding the development of California's long-range transportation plan. Details regarding these requirements can be found in the Plan Development Element.

The CTP 2050 consists of five chapters:

- ▶ **Chapter 1. Introduction.** Describes the plan, its purpose, and how it was developed.

- ▶ **Chapter 2. Our Diverse State.** Explores conditions and trends on California's transportation system, demographics, and travel behavior.
- ▶ **Chapter 3. Our Transportation Vision: Policy Element.** Defines California's long-range transportation vision, goals, and objectives.
- ▶ **Chapter 4. How We Can Make Progress.** Identifies candidate strategies for achieving the vision, describes the scenario development and evaluation process, and provides results of this analysis.
- ▶ **Chapter 5. Our Path Forward: Recommendations Element.** Identifies 14 recommendations to achieve the CTP 2050 vision and goals, and identifies next steps for plan implementation.

The CTP 2050 is also supported by five stand-alone elements, which provide additional detail on plan development, inputs, process, and results.

- ▶ **Strategies Element.** Identifies all potential strategies from a range of sources that can address CTP goals and objectives.
- ▶ **Technical Analysis Element.** Summarizes the approach to data collection, scenario development, modeling and analysis, and economic analysis.
- ▶ **Plan Development Element.** Summarizes the overall approach to the CTP 2050 development, including research and inputs to the process, plan requirements, and public and stakeholder outreach approach and findings.

- ▶ **Financial Element.** Describe sources of funding and financing currently available to support the implementation of the recommendations.
- ▶ **Implementation Element.** Articulates a road map for implementing the plan (expected in 2021).

For further information on the plan, please visit the [CTP 2050 website](#), which contains detailed documentation on plan development, outreach and engagement, and technical analysis.

IMPLEMENTATION

The CTP 2050 offers a roadmap to achieving its vision, but more work is necessary. Following adoption of this plan, Caltrans will develop an Implementation Element, which identifies the requirements necessary to implement the actions identified in this chapter, including agency responsibilities, implementation steps, and timelines.

Unlike RTPs, the CTP 2050 is a financially unconstrained document, meaning that recommendations are not tied to revenues. The identification of funding sources to implement this plan will be critical to ensuring its implementation. The Implementation Element will consider the financial feasibility of recommendations at a high-level, and take financial resources into account when determining roles and responsibility for Caltrans and partner agencies. The Implementation Element will:

- ▶ **Provide details regarding implementation of new and continuing actions**, specifying the lead agency and other parties responsible for implementation of each action, a timeframe for completion and key milestones, and the resources needed to support implementation.
- ▶ **Identify coordinated actions with other state agencies** to maximize implementation potential.
- ▶ **Create a process for monitoring travel, economic, demographic, and other conditions**, that identifies potential indicators of recovery and long-term structural change that could support refinement of the new and continuing actions.
- ▶ **Provide guidance for integration of the CTP with Caltrans modal plans and regional planning efforts**, highlighting specific CTP goals, objectives, performance measures, and strategies that are relevant to each modal plan.
- ▶ **Provide guidance for integration of the CTP into State transportation policies** related to topics like systems planning, corridor planning, project development, design, project delivery, project prioritization, and programming.
- ▶ **Define strategies for ongoing coordination with partners and engagement with the public during plan implementation**, including a steering committee to coordinate overall implementation activities, as well as working groups for specific actions.
- ▶ **Define strategies for coordination within Caltrans** divisions, offices, and districts, to link the CTP vision and goals to a wide range of agency initiatives.
- ▶ **Develop an ongoing performance monitoring process** that reports progress toward all CTP objectives, including both federally required and state-specific.

The Implementation process will begin upon adoption of the CTP 2050, and will inform the next iteration of the CTP, which is anticipated to conclude in 2025.

THE PATH AHEAD

The scope of the CTP 2050 is broad, but its importance is clear. Our transportation system affects every one of us, every day. Adapting this system to better serve the people of California will directly benefit the health, safety, and resilience of our communities. California's path toward a more safe, sustainable, and accessible transportation system will be difficult, but the benefits will be profound. If implemented, the CTP 2050 will reduce transportation-related GHG emissions, free millions from auto dependency, advance transportation equity, and improve quality of life for Californians. To achieve these benefits, we must address many critical challenges facing our state: economic recovery, resilience to future disruptions, addressing the housing shortage and

growing inequality, preparing for a rapidly changing climate, and navigating the uncertain effects of new and emerging technologies.

Our success will depend on the effective management of existing and future resources, research and development that leverages scientific advancements and new technologies, visionary state policies that evolve our regulatory and legal environment to accommodate change, and continued collaboration across regional and jurisdictional boundaries to ensure no community is left behind. Together, California is uniquely positioned to build this brighter future.

1 INTRODUCTION

This chapter introduces the CTP 2050 and provides an overview of the primary issues facing our state. It sets the stage for the vision, goals, and recommendations to follow.

California's transportation system exists to serve its people and their communities. It connects California's nearly 40 million residents to jobs, housing, services, and recreation; and facilitates trade to and from the world's 5th largest economy. But transportation does far more than connect people and goods to their destinations; it plays a central role in our economic opportunities, cost of living, environmental quality, health, and quality of life.

California's population and geography are incredibly diverse. It is home to some of the nation's most populous metropolitan areas, as well as a vast landscape of coastal, mountain, agricultural, and Tribal communities, each of which faces unique transportation needs and challenges. By 2050, California will be home to six million new residents. Approximately a quarter of the population will be over 65, and we will have become even more racially and ethnically diverse.³ These and other changes will impact where people live, their preferred modes of travel, and the transportation options they require to meet evolving needs and preferences.

Over the past two and a half years, hundreds of Californians representing a diverse cross-section of backgrounds, regions, and interests have come together to lay out their vision for a transportation

system that reflects our collective values as a state. They imagine a **safe, resilient, and universally accessible transportation system that supports vibrant communities, advances racial and economic justice, and improves public and environmental health.** The California Transportation Plan (CTP) 2050 is our roadmap for achieving this vision through people-focused policies, strategies, and investments that will improve the lives of all Californians.

A CALL TO ACTION

The CTP 2050 comes at a critical moment in our history, as California struggles to address the damage caused by two destructive forces: the COVID-19 pandemic of 2020 and systemic racial injustice. The arrival of COVID-19 in early 2020 tragically claimed the lives of thousands of Californians, drove state unemployment to 25 percent⁴, and pulled the country into economic recession. The way we live, work, and travel was abruptly transformed. Stay-at-home policies aimed at preventing the spread of the virus have ushered in widespread telework, online shopping, and distance learning; while disruptions to supply chains and demand for home deliveries have shocked our freight system. A safe and healthy path toward economic recovery must be California's top priority, but we must not lose sight of our long-term vision. While COVID-19

virtually eliminated roadway congestion in many cities, vehicle traffic will return as the economy recovers, and may worsen if Californians continue to avoid transit and other shared modes for fear of virus exposure. Managing congestion and expanding transit were priorities before the arrival of COVID-19, and remain essential to achieving a sustainable recovery. This plan seeks to advance the invaluable work of California's regional and local agencies, by offering statewide guidance and leadership to aid in our immediate recovery, and to build more healthy and resilient communities in the years to come.

Amid COVID-19 and the following economic recession, the nation is also experiencing widespread protests against ongoing racial injustice in all aspects of American society. This plan acknowledges the role that transportation has played in creating and perpetuating these injustices. For far too long, transportation decisions have divided communities through redlining, urban highway development, gentrification and redevelopment, and outright discrimination. These decisions have amplified racial inequities by heightening exposure to air pollution in Black and Brown communities and limiting access to jobs, housing, health care, education, and mobility options. These factors have all contributed to people of color being hit hardest by the COVID-19 pandemic and economic recession. This plan seeks to advance racial and economic justice by redirecting resources to marginalized communities; better connecting individuals to jobs, health care, education, and other opportunities; improving environmental justice; and amplifying the voices of those who have been historically excluded from the transportation decision-making process.

While the CTP 2050 is committed to addressing the immediate threats of COVID-19, and long-standing systemic injustice, it also reinforces

California's firm commitment to combatting climate change and the many risks it poses to our infrastructure and communities. The CTP 2050 is required to show how California can reduce transportation sector greenhouse gas (GHG) emissions to 80 percent below 1990 levels by 2050, and support numerous other pieces of ambitious climate legislation.ⁱⁱⁱ This plan demonstrates how advancements in clean fuel technologies; continued shifts toward active travel, transit, and shared mobility; more efficient land use and development practices; and continued shifts to telework, can collectively reduce transportation emissions to support these goals. As it addresses these efforts, the CTP 2050 also reinforces long-held values such as improving system safety, improving mobility and accessibility, advancing environmental health and justice, and enhancing quality of life.

Though California faces many difficult challenges today, there is ample opportunity for positive change on the horizon. We have unprecedented access to technological innovation, transformative policies, and the collective determination required to address our challenges. The CTP identifies 14 recommendations that, if implemented, can help California achieve our bold vision for 2050. While each of these strategies together will be necessary to meet long-term goals, the short-term focus remains on addressing California's most immediate needs, including recovery from the COVID-19 pandemic, advancing racial and economic justice, and improved transportation system resilience.

Successful implementation of this plan will require the sustained commitment and cooperation of the California Department of Transportation (Caltrans) and other State agencies, and the visionary leadership of local and regional partners. By working together across regions and jurisdictional boundaries to implement this plan's

percent clean energy by 2045, and EO N-19-19 requiring California to redouble efforts to reduce GHG emissions.

ⁱⁱⁱ In addition to SB 391, notable California climate legislation includes Executive Order (EO) B-55-18 requiring carbon-neutrality by 2045, SB 100 requiring 100

recommendations, we have the power to achieve our collective transportation vision.

OUR CHALLENGES

Achieving our vision for the future transportation system requires that we acknowledge the many challenges our State faces, both statewide and at the regional and local levels. These include:

- ▶ **PREPARING FOR SYSTEM DISRUPTIONS.** The COVID-19 crisis had a profound impact on California's transportation systems. Almost overnight, roads were no longer gridlocked; transit ridership plummeted; those who could work from home were required to do so; supply chains were stressed, and home deliveries dramatically increased as Californians stayed home. We must ensure that our future transportation system is resilient and can perform its most vital functions, especially in the midst of disruptions.
- ▶ **REDUCING TRANSPORTATION IMPACTS ON PUBLIC HEALTH AND SAFETY.** Transportation directly affects Californian's health and safety. In 2018, there were more than 3,500 traffic-related fatalities on California roads.⁵ Exposure to air pollution from vehicle travel is linked to increasing rates of respiratory and cardiovascular diseases, which are heightened within low-income communities and communities of color. The CTP 2050 aims to reduce transportation-related fatalities and serious injuries to zero, confront environmental injustices head on, and expand access to safe, healthy, and affordable mobility options.
- ▶ **ADAPTING TO A CHANGING CLIMATE.** On a global scale, climate change is manifesting in sea level rise, extreme heat, more frequent wildfires, and shifting snow and rainfall patterns that have serious consequences for human health, safety, and the economy. California's coast must be resilient to 3.5 feet of sea level rise by 2050, which will cause damage to our roads, bridges, airports, seaports, and other infrastructure.⁶ Preparing for these growing risks requires resilient infrastructure, reliable emergency response systems, and mitigating risks with clean transportation options.
- ▶ **REDUCING GREENHOUSE GAS EMISSIONS.** Transportation is the largest contributor to statewide GHG emissions, accounting for 41 percent in 2017.⁷ Despite stringent climate legislation and local and statewide efforts to reduce emissions, California is not on track to meet its target of reducing statewide GHG emissions to 80 percent below 1990 levels by 2050.⁸ The CTP 2050 is required by law to show how the transportation sector will contribute to the mandatory statewide GHG emission reduction target for 2050, and proposes policies and strategies to move California towards a carbon-neutral transportation system.
- ▶ **REDUCING TRAFFIC CONGESTION.** California's urban areas, particularly Los Angeles and the Bay Area, have some of the worst congestion in the nation. This congestion is a byproduct of decades of auto-oriented transportation investments and development patterns that have made active, low-carbon modes of transportation such as biking, walking, and public transit less desirable. It has become abundantly clear that we cannot continue to build our way out of traffic congestion. Instead, the CTP 2050 provides an opportunity to re-assess how we prioritize investments and provide incentives, so that Californians who choose not to drive can do so safely, affordably, and conveniently.
- ▶ **ADVANCING RACIAL JUSTICE.** For far too long, California's Black and brown communities have been disproportionately burdened by transportation policies and planning decisions, leading to lower access to housing, jobs, transportation options and stark disparities in income, health, and access to opportunity. At the same time, marginalized communities continue to be significantly under-

represented in transportation planning and decision-making. To achieve a more just and equitable transportation system, we must center marginalized communities throughout these processes, while correcting past policies that have perpetuated inequities.

- ▶ **CLOSING THE WEALTH GAP.** Despite a recent history of economic growth, the gap between California's rich and poor continues to widen. Between 2006 and 2018, incomes for the top five percent of households grew by 18.6 percent to an average of \$506,421, while households in the bottom 20 percent saw their average income fall by 5.3 percent, to \$15,562.⁹ Income and wealth disparities impact where people live, their mobility options, and access to jobs, goods, and services that are critical to prosperity, health, and security.
- ▶ **ADDRESSING THE HOUSING SHORTAGE.** California is the most populous state in the nation, yet it ranks 49th in housing units per capita. The housing shortage has led to rapidly rising housing costs, with nearly 50 percent of Californians spending more than 30 percent of their income on housing.¹⁰ Rising housing prices are forcing residents to live further from jobs and services. This jobs-housing imbalance is resulting in higher transportation costs and longer commutes for many. Homelessness in California is also growing at an alarming rate, with nearly 150,000 unhoused people in 2019.¹¹ Transportation improvements that support production and preservation of affordable housing in transit-supportive areas, paired with anti-displacement policies, can help California address these pressing issues.
- ▶ **ADAPTING TO A CHANGING ECONOMY.** Global economic trends such as shifting trade patterns, reshoring, the onset of the gig economy, and technologies such as automation, 3D printing, e-commerce, and same and next-day deliveries are dramatically transforming how we live, work, and do business. The CTP 2050 must account for these shifts, leverage opportunities for more

sustainable and equitable goods movement, and continue to foster equitable economic growth.

- ▶ **NAVIGATING THE UNCERTAIN IMPACTS OF EMERGING TECHNOLOGIES.** Connected and autonomous vehicles (CAV), transportation network companies (TNCs), dockless bikes and scooters, and emerging technologies such as drones, artificial intelligence, blockchain, and 5G Internet, are rapidly transforming how people and goods can travel. If unchecked, these technologies could increase auto travel, exacerbate inefficient land use, and pose risks to our safety and privacy. Ensuring that these emerging technologies help rather than hinder California's transportation vision is a priority of the CTP.

OUR OPPORTUNITIES

As we adapt our transportation system to address these challenges, there are numerous opportunities we can leverage to meet our vision. The following opportunities represent renewed potential for California to address our priorities head-on:

- ▶ **CLIMATE LEADERSHIP.** California is a global leader in climate policy, having set aggressive goals to reduce GHG emissions by 2050, and to achieve carbon-neutrality by 2045. Strong climate leadership at the state level and across sectors will be critical to reaching these goals.
- ▶ **LOCAL AND REGIONAL INITIATIVES.** California's metropolitan planning organizations (MPOs), regional transportation planning agencies (RTPAs), and cities are national leaders in crafting innovative solutions to transportation problems through their Regional Transportation Plans / Sustainable Communities Strategies (RTP/SCS) and other efforts. The CTP 2050 aims to advance and build from these efforts.

► **TECHNOLOGY AND INNOVATION.** California is home to some of the world's leading academic and research institutions that are driving technological innovation. Some of the most promising technologies include:

- **ZERO-EMISSION VEHICLES (ZEV).** California has committed to putting 1.5 million ZEVs on California's roadways by 2025 and 5 million by 2030, significantly helping achieve GHG emission reduction targets. Numerous statewide efforts described later in this plan are underway to support this shift, including incentives for ZEVs and investing in charging stations.
- **SHARED MOBILITY** services such as bike-share and car sharing programs can help reduce reliance on single-occupant vehicles, improve first-last mile connectivity to public transit, reduce the need for urban parking, and support more affordable travel options in California communities.
- **BIG DATA** is changing how we travel by enabling new forms of mobility, such as dockless bikes and scooters; integrated routing, booking, and payment; and real-time traveler information systems that help people access a wider range of mobility options.
- **INFORMATION TECHNOLOGY** and expanded internet access are allowing Californians in urban, suburban, and rural areas to work, learn, recreate, and obtain services without taking a trip at all.
- **CONNECTED AND AUTONOMOUS VEHICLES (CAV)** hold promise for improving roadway safety by eliminating human errors and improving accessibility for older adults and people with disabilities. They may also enable us to use limited roadway capacity more efficiently through vehicle platooning and vehicle-to-vehicle communication.
- **GOODS MOVEMENT INNOVATIONS** such as same-day deliveries, alternatives to truck last-mile delivery, alternative fuels

for freight vehicles, 3D printing, and advancements in logistics hold promise for reducing the significant traffic and emissions footprints of our freight system.

As California traverses these complex challenges and opportunities, one thing is certain: maintaining the status quo is not an option. The CTP presents a unified policy framework supported by recommendations and actions that can collectively position the state to address each challenge and capitalize upon each opportunity. The following sections explain the purpose of the CTP 2050, how it addresses changing priorities amidst the COVID-19 pandemic, its relationship to other state and regional efforts, and how it can help us achieve our bold vision for the future.

THE PLAN

The CTP is California's long-range transportation plan, which is updated every five years pursuant to state and Federal law, offering an opportunity to identify new and innovative solutions to our most pressing transportation challenges. The CTP is designed to provide a unifying and foundational policy framework for making effective, transparent, and transformational transportation decisions in California. It is intended to guide transportation decision makers at all levels of government, while emphasizing the importance of shared responsibility in meeting our transportation needs. It identifies a vision for the future transportation system, establishes new statewide priorities, and serves as a roadmap to guide Caltrans and partner agencies in implementing these recommendations.

Although it is a statewide plan, the CTP 2050 recognizes and is sensitive to the unique transportation needs and interests of California's urban, suburban, rural, and Tribal communities. Once adopted, the CTP 2050 informs future modal and regional plan development, and can be used to support cross-agency collaboration to achieve shared goals.

FEDERAL REQUIREMENTS FOR PERFORMANCE MANAGEMENT

MAP-21 and the FAST Act established performance-based planning requirements for state DOTs and MPOs to address the many challenges facing the U.S. transportation system, including improving safety, maintaining a state of good repair, reducing traffic congestion, improving system efficiency and goods movement, protecting the environment, and reducing delays in project delivery. Performance management requirements are codified in the CFR through several rulemakings that establish federal performance measures in the areas of highway safety, pavement and bridge condition, system performance, and transit safety and transit asset management. Per 23 CFR 450.216, the CTP 2050 must include a description of the federal performance measures and targets used in assessing the performance of the transportation system. California has established targets for safety (PM 1), pavement and bridge condition (PM 2) and system performance (PM 3). These targets are included in the Plan Development Element.

COORDINATION WITH OTHER PLANS

The CTP 2050 is just one of many critical state and regional plans aimed at improving California's transportation system. As the guiding document for statewide and regional transportation policy, the CTP 2050 is both informed by, and informs, other state and regional plans and programs. These are described in the following sections. For more detail on what is included in each of these plans, and how they informed the development of the CTP 2050, see the Plan Development Element.

Caltrans Modal Plans

The CTP 2050 goals, objectives, and recommendations will inform the next round of updates to Caltrans' six modal plans, summarized in Figure 4. While the CTP provides the overarching policy framework for transportation in California, Caltrans modal plans focus on priorities for specific modal components of the statewide transportation system. The CTP and Caltrans' modal plans are developed on an iterative cycle, continuously informing one another. Unlike the CTP, the modal plans can include specific projects, making them the first step in implementing the CTP's policies, some of which are mandated.

Other Statewide Plans

The CTP is informed by multiple, parallel state planning efforts focused on transportation and adjacent topics, such as climate change, energy, air and water quality, conservation, health, mobility, housing, infrastructure, economic growth, safety, and equity. Key plans include the Climate Change Scoping Plan, Sustainable Freight Action Plan, High-Speed Rail Business Plan, Statewide Housing Assessment, and Strategic Highway Safety Plan. The CTP 2050 reflects and expands on these and other key plans, supporting state policy across all sectors.

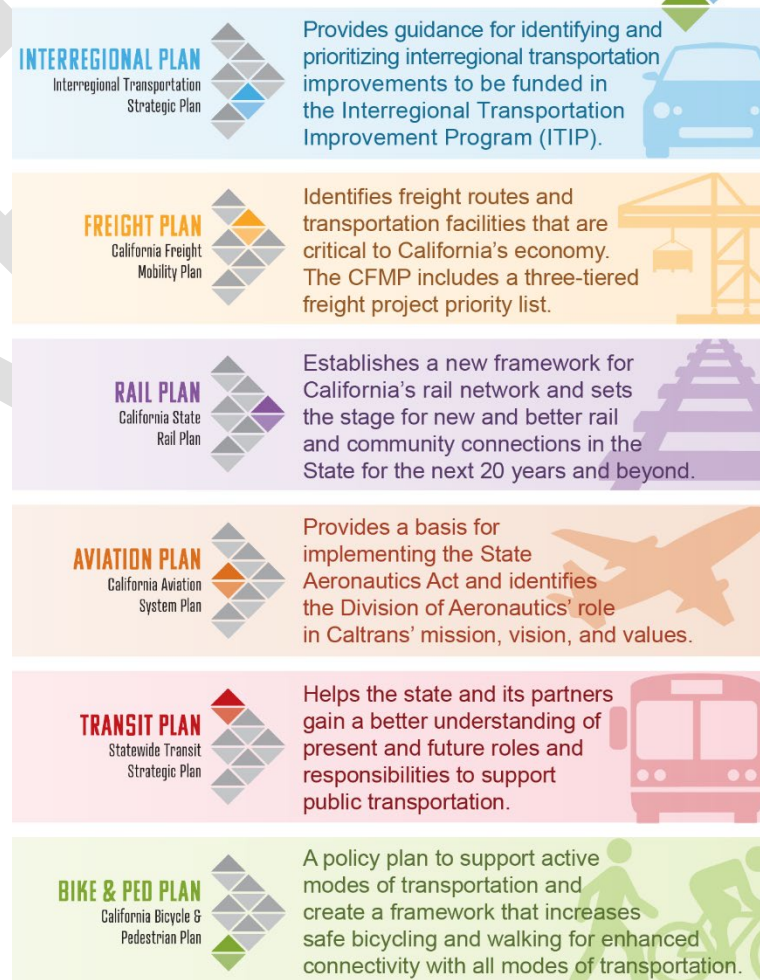
FIGURE 4 CTP 2050 RELATED PLANS AND PROGRAMS

OTHER STATEWIDE PLANS AND RESOURCES



CALTRANS MODAL PLANS

CTP 2050



Regional Plans

California's 18 MPOs and 26 RTPAs are responsible for regional transportation planning activities. A key planning function of MPOs and RTPAs is to develop RTPs, which serve as a policy framework for long-range planning and guide the programming and allocation of funds at the regional level. Unlike the CTP 2050, RTPs include a financially constrained project list that must undergo environmental review and be consistent with air quality conformity requirements. Under SB 375, MPOs are required to adopt SCSs as part of their RTPs. These SCSs demonstrate how integrated land use and transportation strategies will support the attainment of California Air Resources Board (CARB) emissions reduction targets. The CTP 2050 reflects a breadth of regional planning efforts, including evaluation and review of SCS's from 18 MPOs.

HOW THE PLAN WAS DEVELOPED

The CTP 2050 was developed over a 2-year period that included extensive public outreach; engagement from state, local, and regional partners; research and analysis; and oversight from four committees and eight groups of subject matter experts. This collaborative process ensured that the CTP 2050 vision, goals, and recommendations reflect the diverse voices of urban, rural, suburban, and Tribal communities across California, as well as input from leading transportation experts and policy-makers. Through the Tribal Listening Sessions, Visioning Sessions, and Stakeholder and Public Workshops, we received input from public agencies, private organizations, and thousands of California community members. Public outreach and stakeholder engagement activities are shown in Figure 5. For more detailed information on public engagement, see the Plan Development Element.

The CTP 2050 recommendations are based on robust, technical analysis that was used to explore how socioeconomic trends, land use shifts, changes in travel preferences, and other factors will affect future transportation system performance, and impacts on emissions and economic growth. The technical analysis was conducted using three modeling tools: the California Statewide Freight Forecasting and Travel Demand Model

Recent Priorities from California RTP/SCSs

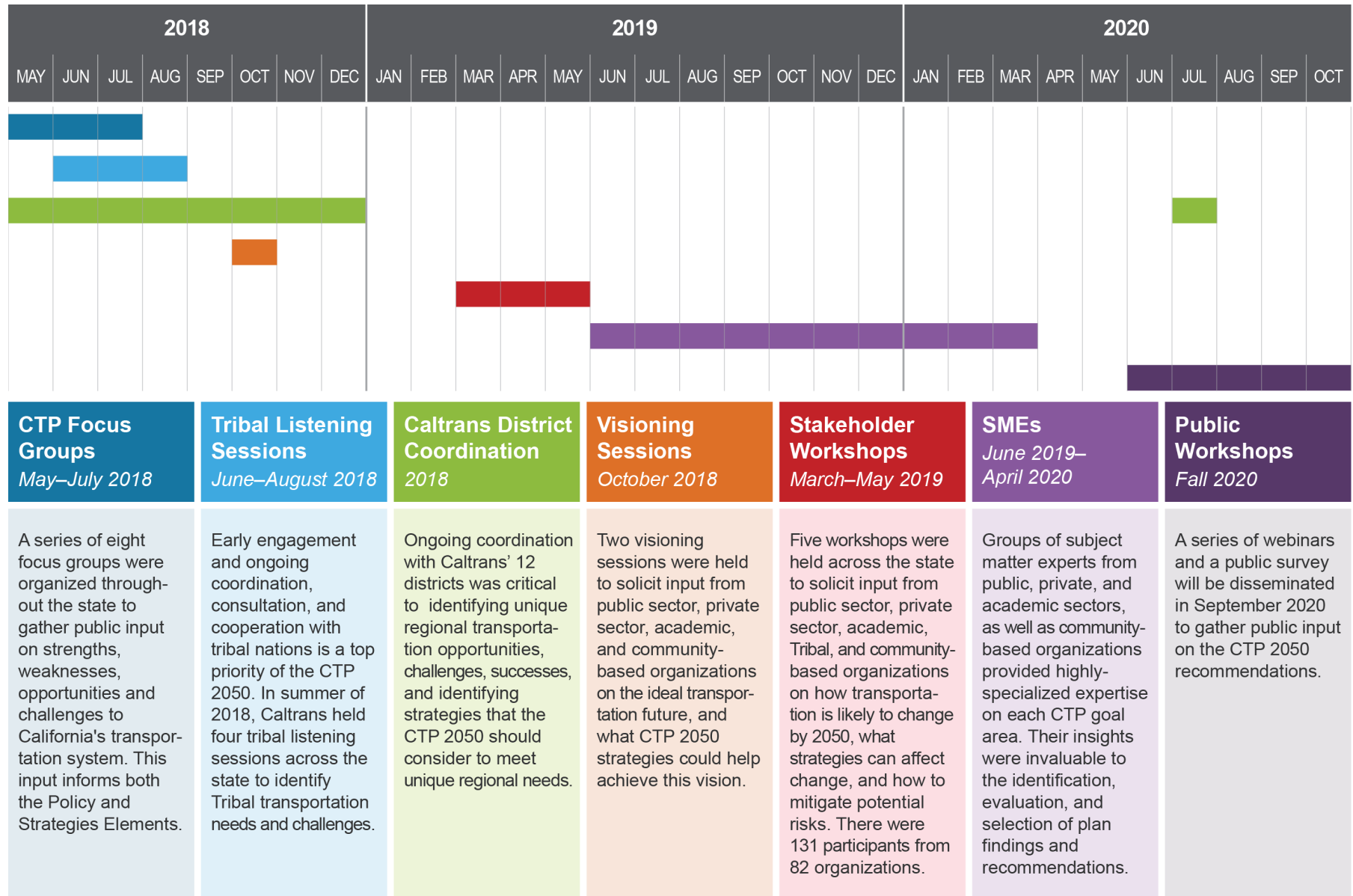
- ▶ Expanding **transit** capacity, frequency, reliability, and connectivity.
- ▶ Investing in safe and robust **bicycle and pedestrian infrastructure** to improve public health and safety.
- ▶ Implementing **transportation demand management** strategies to reduce congestion, reduce single-occupant vehicle use, and improve mobility and air quality.
- ▶ Encouraging smart growth policies that promote a **mix of land uses**, compact and infill development, and transit-oriented development.
- ▶ Supporting **mobility innovations**, including autonomous and connected vehicles, zero-emission vehicles, shared-use mobility, and coordinated intelligent transportation systems.
- ▶ Enhancing **project delivery** through efficient use of funding and broadened stakeholder collaboration.
- ▶ Supporting **economic development** through enhanced freight mobility and intermodal connectivity.
- ▶ Ensuring **equitable access** to the transportation system.
- ▶ **Rebalancing housing** by focusing growth near employment centers and ensuring that housing options are available to all segments of the population.

(CSF2TDM), CARB's Vision model which forecasts future transportation emissions, and the Transportation Economic Development Impact System (TREDIS), which forecasts future economic conditions based on transportation improvements. Off-model techniques based on research, best practices, and qualitative methods were used to evaluate plan elements that could not be modeled using these tools. Documentation of the complete approach to technical analysis in the CTP 2050 is available in the Technical Analysis Element.

Based on the results of this analysis and the input of stakeholders and the public, the CTP 2050 identifies 14 recommendations to achieve California's climate goals, and other plan goals identified in Chapter 3. In addition to being vetted through public outreach, the CTP 2050 was heavily guided by four oversight committees: the Caltrans Management Steering Committee (MSC), the Policy Advisory Committee (PAC), the Technical Advisory Committee (TAC), and the Economic Technical Advisory Team (ETAT). Committee membership, roles, and responsibilities are shown in the Plan Development Element.

The CTP 2050 was developed in accordance with the CTP Guidelines developed by the California Transportation Commission (CTC) in May 2017. The CTC Guidelines serve as a blueprint for the development of the CTP, ensuring it reflects a cohesive state policy framework, and is compliant with federal regulations and state statutory requirements. This document addresses all requirements identified in the CTC Guidelines, which can be viewed [here](#).

FIGURE 5 STAKEHOLDER ENGAGEMENT TIMELINE



ADDRESSING COVID-19

The unexpected arrival of COVID-19, which has claimed the lives of thousands of Californians, created an unprecedented disruption to all aspects of our society and economy, including transportation. On March 19, 2020, Governor Gavin Newsom mandated a statewide stay-at-home policy, making California the first state to do so in response to the pandemic. State, regional, and local public health measures implemented to limit the virus' spread, including recommended physical distancing of six feet, had profound impacts on how Californians live, work, and travel; and how goods move throughout the state. The abrupt economic downturn caused by COVID-19 will have consequences for years to come, affecting how people use the transportation system, and intensifying the hardships faced by California's most marginalized communities.

The CTP 2050 development process began in early 2018, involving two years of research, outreach, engagement, and analysis, and culminating in an internal draft plan prior to the arrival of COVID-19 in California. While this work remains invaluable, addressing the pandemic's immediate impacts and potential lasting changes on our communities, economy, infrastructure, and travel behavior, is critical. While it is too soon to predict and understand its long-term effects, COVID-19 must be taken into account as we evaluate the strategies necessary to meet our transportation vision and goals.

This section assesses the immediate observed impacts of COVID-19 on commuting, transit, active travel, air travel, and other trends based on information available as of June 2020. It also describes how the CTP 2050 process was revised to ensure it remains relevant and responsive to the crisis and its aftermath. We do not know how long COVID-19 will be here, nor how permanent its impacts will be. Traffic congestion has already begun to revert to pre-COVID-19 levels in some areas, but it may

very well decline again if further stay-at-home policies are mandated. These uncertainties underscore the importance of having a transportation plan that is flexible and responsive to changing circumstances.

Observed Transportation Impacts

The transportation impacts of COVID-19 are the product of two forces; first, the economic downturn, which has affected travel demand, altered supply chains and demand for goods, and placed added pressures on California's most vulnerable communities; and second, a shift in how frequently people travel, where they travel, and what modes they choose. Observed changes to how people and goods travel across the nation and in California include:

- ▶ **TELEWORK, TELEHEALTH, AND DISTANCE LEARNING.** Stay-at-home policies throughout the state required offices to close, medical centers to postpone elective surgeries and procedures, and schools to immediately transition to distance learning. In response, people turned to virtual applications to work, obtain services, and recreate from home. It is estimated that 34 percent of commuters began working from home during the pandemic, with some employers, announcing plans to permanently shift to elective work-from-home policies.¹²
- ▶ **REDUCED ROADWAY CONGESTION.** Global estimates from cell phone data and toll collections suggest a 40 percent reduction in nonfreight travel due to COVID-19, which virtually eliminated roadway congestion in most U.S. cities immediately following stay-at-home policies.¹³ In California alone, VMT on State highways declined by 55 percent in March 2020.¹⁴ More recent data suggests congestion has begun to rise once more.

- ▶ **REDUCED TRANSIT AND RAIL RIDERSHIP.** Travel on transit declined substantially during the onset of COVID-19. With nearly 40 million residents participating in physical distancing, transit agencies implemented a variety of rider restrictions and policies to maintain public health. As of March 2020, LA Metro reported an estimated 68 percent reduction in bus ridership and an 81 percent reduction in rail transit boardings.¹⁵ Amtrak's CEO estimated a national ridership decline of roughly 95 percent.¹⁶ A recent study shows that Americans are now over 50 percent less likely to use public transportation, and individuals age 65 or older are far less likely to do so.¹⁷ Additionally, lost fare revenues and sales taxes are forcing transit agencies to make tough choices about how to best provide service on a very limited budget.
- ▶ **INCREASING ACTIVE TRANSPORTATION.** In the months following the outbreak of COVID-19, more Americans embraced active travel. California cities that typically have low bicycle ridership, such as Riverside and Oxnard, experienced a 90 to 125 increase in bicycle miles traveled.¹⁸ Stockton, Bakersfield, Fresno, Sacramento, and San Diego also experienced increases of more than 50 percent.¹⁹ Trends suggest that travelers shifted from transit to active travel when risks increased.²⁰ In San Francisco, many residents who needed to make essential trips opted to walk or bike²¹. Recreational biking and walking have also skyrocketed. The Rails-to-Trails Conservancy observed a 110 percent increase in trail use compared to the same period in 2019.²²
- ▶ **DECLINING SHARED MOBILITY USE.** Since the onset of COVID-19, ride-hailing and micromobility companies such as Lyft and Uber have seen an immediate decline in users.²³ TNCs and ride-hailing services suspended cheaper shared carpooling and ride splitting options during COVID-19 to adhere to physical distancing guidelines.²⁴ Consumer data indicates that spending for ride-sharing

services is down nearly 83 percent.²⁵ The financial future of TNCs in the wake of these developments is increasingly uncertain.

- ▶ **CHANGES TO GOODS MOVEMENT.** The COVID-19 pandemic disrupted global supply chains as changing demand for food products and increased demand for medical and cleaning supplies and home deliveries skyrocketed almost overnight. At the same time mass unemployment, decreased consumer spending, and decreased production caused global trade to plunge by an estimated 13 to 32 percent²⁶, resulting in an overall reduction in goods movement. Initial analysis of cell phone data showed that long-haul truck traffic was relatively flat, while local area commercial vehicle traffic declined by 10 percent.²⁷ Early research indicates that the Port of Los Angeles container counts were down more than 30 percent in March 2020 compared to the same time in 2019.²⁸
- ▶ **REDUCED COMMERCIAL AIR TRAVEL.** Nationwide enplanements following the COVID-19 crisis declined 93 percent compared to the same period in 2019.²⁹ Domestic and international travel restrictions and stay-at-home orders significantly reduced tourism and associated economic benefits. Grounded planes and restricted air travel also caused major delays and disruptions to air-cargo, which often consists of important high-value goods.

Other transportation-related impacts in the wake of COVID-19 have included:

- ▶ **INCREASED PRESSURES ON MARGINALIZED COMMUNITIES.** Transit agencies have significantly cut services as ridership and revenue have plummeted, limiting the accessibility of zero-car households and Californians who depend as their primary mode of transportation. Many Californians that depend on transit are essential workers, who are predominantly low-income people and people of

color. These essential workers are at a much higher risk of exposure to COVID-19 than those with the flexibility to work for home and use a personal vehicle for travel.

- ▶ **ROAD SAFETY.** Traumatic injuries from traffic collisions were reduced by 50 percent as a result of reduced auto travel in the wake of COVID-19.³⁰ A 50 percent decrease in single-occupancy vehicle (SOV) crashes was also observed since stay-at-home policies began.³¹ While crashes have declined, a recent California Highway Patrol (CHP) report showed a statewide increase of 87 percent in citations for speeding more than 100 mph.³²
- ▶ **REDUCED EMISSIONS OF AIR POLLUTANTS AND GHGS.** In California, mobile sources (heavy-duty trucks, ships, trains, planes, etc.) account for roughly three quarters of the NOx (oxides of nitrogen) emissions, which is a key component to the formation of smog pollution.³³ According to the American Lung Association, nearly 98 percent of all Californians live within counties ranked F for poor air quality. In March, Los Angeles experienced an estimated 33 percent reduction in nitrogen dioxide (NO₂), which is emitted by burning fossil fuels.³⁴ While it may be too soon to tell how COVID-19 has impacted air quality throughout California, March and April satellite imagery from the National Oceanic and Atmospheric Administration (NOAA) indicate a dramatic reduction of NO₂ air pollution nationwide.³⁵
- ▶ **DECLINING TRANSPORTATION REVENUES.** Revenue declines due to reduced travel and spending are significantly impacting transportation agencies across California. U.S. transit agencies are collectively facing a funding shortfall of \$48.8 billion between mid-2020 and the end of 2021, which includes the \$25 billion provided by

the Coronavirus Air, Relief, and Economic Security Act (CARES) in April 2020.³⁶ The Bay Area Rapid Transit District (BART) has anticipated losses of roughly \$57 million per month, with other transit agencies around the state experiencing similar shortfalls.³⁷ The CARES Act included \$3.7 billion in Federal stimulus to aid struggling transit systems in California cities and Tribal Reservations.³⁸ Gas tax revenues are expected to decline significantly as well. According to a recent UC Davis study, reduced vehicle traffic led to an estimated 75 percent reduction in fuel tax revenue between March and April 2020.³⁹ Cap-and-trade revenues that the State uses to fund transportation programs such as the Transit and Intercity Rail Capital Program (TIRCP) and Low Carbon Transit Operation Programs (LCTOP) are being dramatically reduced as well.⁴⁰

To address the significant uncertainties caused by COVID-19, an evaluation process was used to assess the performance of plan recommendations under a range of potential paths to recovery, each of which consider alternate rates of economic growth and travel preferences. The evaluation process is summarized in Chapter 4, and additional detail can be found in the Technical Analysis Element. The evaluation resulted in the addition of plan recommendations, such as to expand remote access to jobs, goods, services, and education, and refinement of existing recommendations around transit, land use, pricing, and technology to ensure that these solutions are responsive to the changing travel needs and preferences of California communities in the post-COVID-19 world.

HOW TO USE THE PLAN

So far, we've explored some of the major challenges and opportunities facing our state, what the CTP 2050 is and does, and how it was developed. But how can the CTP 2050 help you? Whether you are a member of the public interested in how transportation affects your community, a policy-maker seeking guidance on regional or local planning, or a private sector professional interested in where the transportation system is heading, this plan can help you:

- ▶ Understand key trends, challenges, and opportunities facing our state (Chapter 2)
- ▶ Explore our vision for California's future transportation system, and the goals and objectives we hope to achieve (Chapter 3)
- ▶ Understand the benefits of this plan (Chapter 4)
- ▶ Review the recommendations and actions that, if implemented, will bring these benefits to California (Chapter 5)

For further information and to view supporting documentation for the CTP 2050, please visit the [CTP 2050 website](#).

FIGURE 6 CTP 2050 PLAN TERMINOLOGY

Vision

Guiding vision for our ideal future transportation system

Goals

Broad focus areas that reflect state transportation priorities

Objectives

Specific aims that support each goal and help guide the selection of CTP recommendations

Strategies

Potential solution for addressing CTP goals and objectives

Recommendations

Strategies that have been screened and demonstrate ability to achieve the vision

Actions

Specific, implementable actions that support a CTP recommendation

Performance Measures

Key performance indicators that monitor progress toward achieving the vision

2 OUR DIVERSE STATE

This chapter identifies conditions and trends in California's transportation system, and how the system may change by 2050. It describes demographic, land use, and economic trends; challenges and opportunities associated with each; and implications for our future transportation system. This foundational information is critical to identifying responsive strategies, evaluating future transportation scenarios, and selecting plan recommendations.

OUR GEOGRAPHY

California is the third largest state in the U.S. geographically, and is home to some of the Nation's most diverse regions and ecosystems. Major metropolitan areas such as Los Angeles and the San Francisco Bay Area are located along the Pacific Coastline, with the iconic Sierra Nevada mountains to the east, redwood forests in the northwest, and the Mojave Desert in the southeast. The San Joaquin Valley, located in the state's center, is an agricultural engine that produces a quarter of the nation's food.⁴¹ Transportation needs vary drastically across coastal and inland communities, across northern and southern parts of the state, and across mountain and Tribal communities. For example, major cities with growing traffic congestion and housing shortage and affordability issues are facing a very different set of challenges than rural areas struggling with poor connectivity and access to multimodal options. The varying transportation challenges and opportunities in California's urban, suburban, and rural areas are presented in Table 1. The CTP 2050 is a plan for all California communities, providing policies that reflect the state's range of transportation needs.

FIGURE 7 CALIFORNIA REGIONS



TABLE 1 TRANSPORTATION CHALLENGES AND OPPORTUNITIES BY GEOGRAPHY

Geography	Challenges	Opportunities
Urban	<ul style="list-style-type: none"> ■ Housing availability and affordability ■ Gentrification and displacement of lower-income residents ■ Managing traffic, curb space, and right-of way ■ Incompatible land uses, in some cases ■ Disconnected bike lanes/trails 	<ul style="list-style-type: none"> ■ Land use that supports high-capacity transit and active travel ■ Increased demand for transit and active travel ■ Mobility as a service (MaaS) and new mobility to improve transit access
Suburban	<ul style="list-style-type: none"> ■ Auto-oriented development patterns ■ Roadway congestion ■ Growing travel times ■ Limited access to transit ■ Limited access to bike lanes/trails 	<ul style="list-style-type: none"> ■ Repurpose underutilized land uses (e.g., malls, parking lots) to support quality of life ■ CAV to improve safety ■ MaaS to improve transit access
Rural and Tribal	<ul style="list-style-type: none"> ■ Development encroachment into open space, agriculture, and natural habitats ■ Lack of travel options, for both people and freight ■ Improve travel conditions for bicyclists and pedestrians ■ Projects often uncompetitive for grant funding 	<ul style="list-style-type: none"> ■ Technology to reduce the need for long-distance travel ■ ZEV to reduce emissions ■ MaaS and new mobility as an alternative to transit ■ Streamlined interregional transit fares and transfers

OUR PEOPLE

California's transportation system exists to serve its residents. Understanding California residents is critical as we plan for a transportation system to meet their diverse needs. This section explores trends in population and key demographic groups to shed light on how these trends may lead to changing travel needs and preferences by 2050.

Population

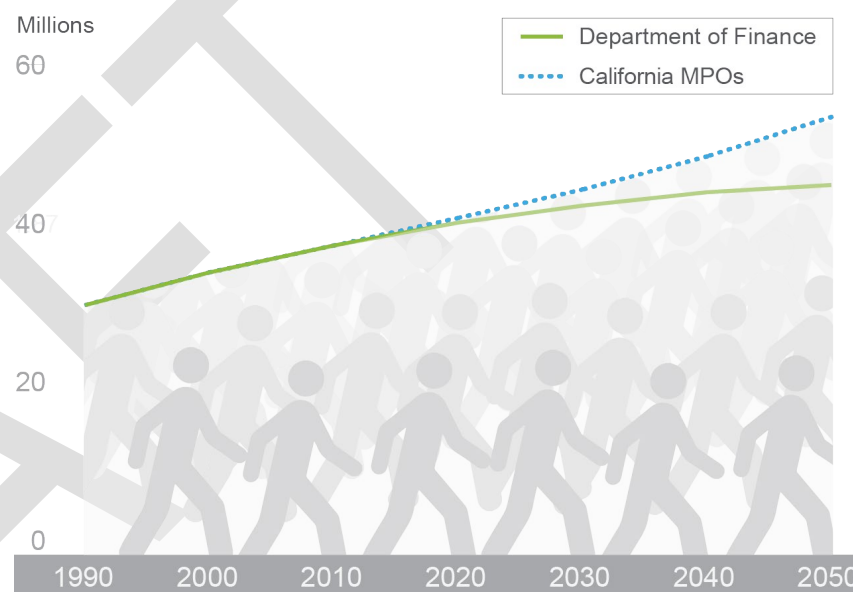
- ▶ **TODAY.** California is home to nearly 40 million residents, about 12 percent of the U.S. population.⁴² The greater Los Angeles and the San Francisco Bay Area are California's largest population centers, home to nearly half of the state's population. Yet inland areas in the Sacramento region, Central Valley, and Inland Empire have been growing at the fastest rate. Nevertheless, the Los Angeles and Bay Area regions continue to have the highest population density by far.
- ▶ **BY 2050.** California's population will grow by an estimated six million residents by 2050.⁴³ This reflects the most recent population projections developed by the California Department of Finance (DOF). California's MPOs have forecasted growth of up to 13 million new residents by 2050. Despite the difference in magnitude, both projections shows that coastal urban areas such as the Bay Area, Los Angeles, and San Diego will retain the majority of the state's population, while the Central Valley and Inland Empire will continue to grow at the fastest pace.⁴⁴

As our population grows, so will demand for travel. Accommodating this growth in a way that aligns with environmental, economic, and equity priorities is a critical challenge that the CTP 2050 must address. The following sections expand on key demographic trends, highlighting the implications of each for the future of mobility in California.

How many Californians will there be by 2050?

The 2050 population forecasted by California's MPOs (53 million) is significantly greater than the latest forecasts provided by the California Department of Finance (45 million). Population forecasts have a considerable impact on estimated future vehicle travel, delay, and emissions. The impact of different population growth rates on these important measures is discussed in Chapter 4.

FIGURE 8 POPULATION GROWTH (1990 – 2050)



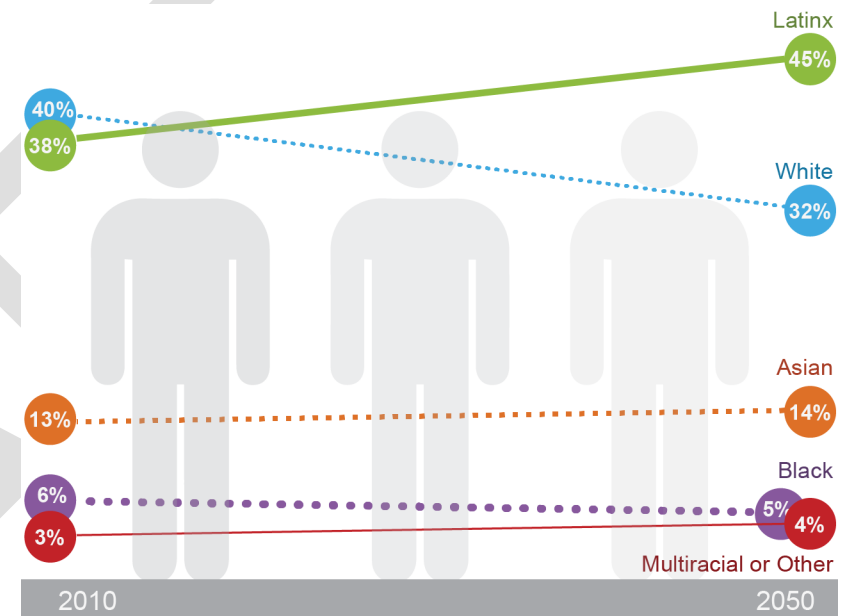
Source: California Department of Finance and CSF2TDM.

Demographic Trends

As California grows over the coming decades, the demographics of our communities will change as well. Transportation needs and preferences differ based on age, income, race, ethnicity, national origin, gender, sexual orientation, and ability, which is why it is fundamental to consider diverse perspectives when planning for the future transportation system. The following are some of the key demographic trends in California.

- ▶ **GROWING RACIAL AND ETHNIC DIVERSITY.** California's population is becoming increasingly diverse, with no racial or ethnic group making up a majority of our population. Latinx groups make up nearly 40 percent of the state's population, surpassing whites as the largest ethnic group in 2015. This trend is expected to continue through 2050. California also has the nation's largest immigrant population, with 27 percent of Californians being foreign-born. As discussed in Chapter 1: Our Challenges, transportation benefits and burdens are not evenly distributed across racial groups. The CTP 2050 is committed to addressing this challenge by providing safe, reliable, and affordable transportation to those who need it most, and those who have been historically impacted by transportation decisions.
- ▶ **A GROWING WEALTH GAP.** The wealth gap between rich and poor Californians has been growing for decades. Between 2006 and 2018, incomes for the top five percent of households grew by 18.6 percent to an average of \$506,421, while households in the bottom 20 percent saw their average income fall by 5.3 percent, to \$15,562.⁴⁵ Stagnant wages, paired with a rising cost of living, have heightened the economic burden on California's low- and middle-income residents. Transportation is now the second highest household expenditure in California—after housing.⁴⁶ Making sure that residents have access to affordable mobility options is central to reducing the cost of living and increasing access to opportunity for those who are struggling financially.

FIGURE 9 POPULATION BY RACE (2010 – 2050)



Source: California Department of Finance.

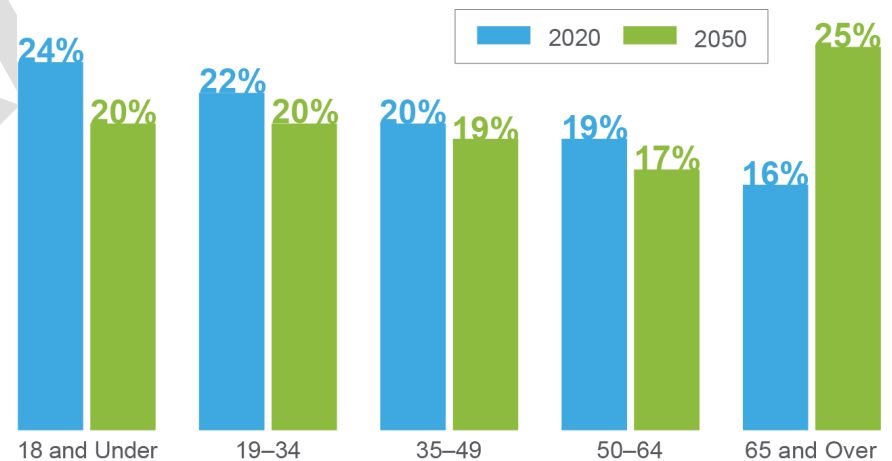
► **AN AGING POPULATION.** Adults over 65 are expected to make up more than a quarter of California's population by 2050. As people age, transportation patterns and needs change. Those in retirement no longer commute but may make more trips for shopping and recreation or require greater access to medical and social assistance facilities. For some, driving may no longer be an option, initiating greater reliance on public transportation and door-to-door services. The aging population will also impact future land use, with uncertainty around whether older adults will age in place (stay in current homes) or move into smaller homes in more dense areas. With more than half of the older adult population living in suburban areas, aging in place could pose challenges for meeting future mobility needs with non-auto modes. Nevertheless, self-driving technologies and new forms of on-demand mobility may offer more reliable, affordable mobility options for California's aging communities.

► **PEOPLE WITH DISABILITIES.** One in 10 Californians lives with a disability, and many elements of the transportation system are not designed to accommodate the mobility needs of people with disabilities. As the population ages, the share of Californians living with a disability is expected to increase. People with disabilities often rely on public transit to meet daily travel needs, as well as door-to-door services such as paratransit. The transit systems of the future, whether they are fixed-route, shared, or on-demand, must address the mobility needs of residents with disabilities. First- and last-mile access to transit is particularly important, as well as Complete Streets that incorporate principles of universal design, such as pedestrian crossing beacons and wheelchair-accessible ramps. These features must continue to be integrated into state and local planning efforts to better serve people with disabilities.

ENVIRONMENTAL JUSTICE IN CALIFORNIA COMMUNITIES

People of color face higher exposure to traffic safety risks and air pollution. Between 2009 and 2014 the rate of pedestrian fatalities per 100,000 people was 1.7 among African Americans and 4.5 among Native Americans, compared to 0.93 among white Americans.¹ Higher exposure to air pollution among low-income people and people of color has also led to increased rates of health and respiratory disease. This is due to decades of land use and transportation planning that have located low-income communities of color in close proximity to major sources of pollution such as ports and industrial activities centers. Without intervention, environmental justice concerns will be exacerbated by climate change, with five of California's smoggiest cities projected to see the highest ozone increases associated with climate change.

FIGURE 10 POPULATION BY AGE COHORT (2020 – 2050)



Source: U.S. Census Bureau American Community Survey; 5-year estimates.

Tribal Nations

California has the largest Native American population of any U.S. state, with 109 federally recognized tribes in 34 counties, and many without Federal recognition. There are almost 100 Tribal reservations (Rancherias) throughout the state, and large groups of Native Americans (indigenous Californians and other Native peoples) living in major urban areas such as San Francisco, San Jose, San Diego, and Los Angeles. Federally recognized Tribes are sovereign nations, administering programs and providing services to Tribal and non-Tribal members of the community. In accordance with EO B-10-11 (2011), California engages with Native American groups in consultation of transportation planning activities and for the advancement of environmental justice goals.

Federal and states laws are also in place to protect tribal lands, assets, resources, and rights for the benefit of tribes and their members. The California State Transportation Agency (CalSTA) Tribal Transportation Policy obligates respect for tribal sovereignty and pursuit of good-faith relations with tribes and the Director's Policy 19, "Working with Native American Communities", requires the Department to "recognize and respect important California Native American rights, sites, traditions, and practices" as well as to "[consult] with tribal Governments prior to making decision, taking actions or implementing programs that may impact their communities." The Caltrans Native American Liaison Branch (NALB) serves as a liaison between Caltrans, the 109 Federally recognized tribes in California; state, local, and regional transportation agencies; and other key stakeholders. NALB facilitates compliance with Caltrans policy and federal statutes and regulations for Tribal Governments involvement in transportation planning and programming. The program also works to help California Native American communities identify and implement transportation safety solutions that will lead to improved safety for all motorists, passengers, bicyclists, and pedestrians, as well as help Tribal governments identify potential sources of funding for improvements.⁴⁷

Tribal Transportation Needs

Tribal listening sessions were held across the state to better understand the transportation needs facing Tribal communities.

The following key themes emerged:

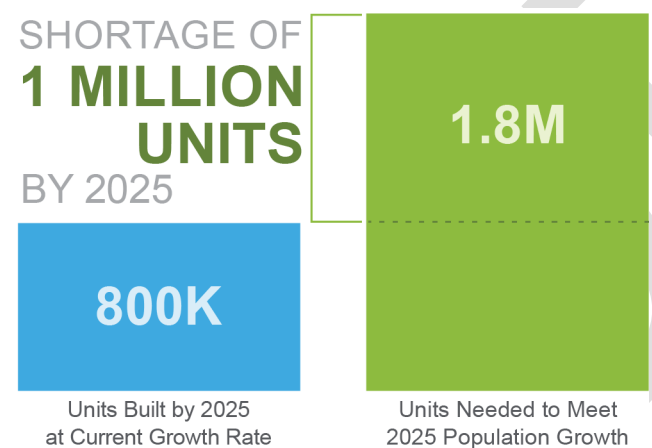
- ▶ Reliable access to Tribal lands
- ▶ Road safety
- ▶ Multi-jurisdictional communication
- ▶ Inadequate funding
- ▶ Transportation planning capacity
- ▶ Multimodal mobility
- ▶ Culture resources protection
- ▶ Emergency response
- ▶ Training and technical assistance
- ▶ Active partnerships

OUR HOUSING

Housing and transportation are deeply intertwined. The location and availability of housing determines how far people need to travel, how much they spend on transportation, and what mode of transportation they use—all of which directly impact cost of living, quality of life, and environmental sustainability.

TODAY. California is facing a growing housing shortage and affordability issue, ranking 49th out of 50 states in housing units per capita.⁴⁸ In 2018, there was a shortfall of more than one million rental homes that are affordable to extremely- and very low-income households, and California's homeownership rate has declined to the lowest rate since the 1940s.⁴⁹ The housing shortage has caused a rapid increase in housing costs, which disproportionately impacts California's most vulnerable populations, and has led to an increasing jobs-housing imbalance. About one-half of California households are cost burdened, meaning more than a third of household income is spent on housing.⁵⁰ The ramifications of housing shortages in urban regions, in addition to gentrification and displacement (described below), include increased congestion and GHG emissions as Californians move further from jobs, goods, and services and therefore rely more heavily on their cars as the dominant travel mode. This has led to an increase in "super commuting," which refers to those who travel more than 90 minutes each way to work. Super commuting is not only costly to commuters, but impacts physical and mental health and takes away time people have for other activities. Integrating transportation and land use planning to reduce the jobs-housing imbalance, reduce super commuting, and ensure that Californians have access to affordable housing and mobility options can help alleviate economic hardships associated with the housing shortage.

FIGURE 11 CALIFORNIA HOUSING DEMAND



Source: 2018 California Statewide Housing Assessment.

Gentrification and Displacement

With housing prices on the rise and growing demand for housing in urban areas, many urban neighborhoods are experiencing gentrification and displacement, pushing lower income residents, most of whom are people of color, into exurban areas with longer, more costly commutes. Investments in transit and active transportation have been cited as one of many factors linked to gentrification. While these investments are intended to expand affordable, sustainable mobility options in low-income communities and communities of color, they also attract higher-income earners, thereby driving up housing prices and leading to displacement. To protect residents and advance racial and economic justice in California communities, these investments must be paired with anti-displacement policies.

Unhoused Californians

Nearly a quarter of all unhoused people in the U.S. reside in California, yet California is home to only 12 percent of the U.S. population. Unhoused populations are most concentrated in major metropolitan areas, with more than one in three unhoused people residing in Los Angeles County. A lack of reliable, affordable mobility options is one of many barriers unhoused people face in accessing work, education, health care, and other critical services. Unhoused people also face higher rates of exposure to air pollution, noise, and safety risks associated with transportation. The economic recession caused by COVID-19 is expected to lead to a rise in people living on the streets, where people are subject to increased risk of infection. Supporting unhoused people in obtaining safe housing options, and access to essential services, is becoming an increasingly important role for transportation agencies across the state.

BY 2050. Approximately 1.8 million new housing units are needed by 2025 to meet projected population and household growth in the state.⁵¹ This is equal to 180,000 new homes annually over a 10-year period, a significantly higher annual production rate than seen in the last decade. Governor Newsom's state budget allocates \$1.3 billion in one-time grants and loans to aid localities in building affordable housing units alongside new housing production goals.⁵² The Governor's plan proposes 3.5 million new units to be built by 2025, for all income levels, increasing the rate at which housing is built each year while also meeting the state's total housing needs.

CASE STUDY: ORLEANS COMMUNITY CONNECTIVITY PROJECT

In coordination with Caltrans District 1 and funding support from a Caltrans Sustainable Transportation Planning Grant award, the Karuk Tribe led the Orleans Community Connectivity project to redesign a walkable, bikeable, and safe community core. The project extends three quarters of a mile along Highway 96 in Humboldt County and includes reducing travel lane widths, adding pedestrian crossings, and enhancing safety by building a multi-use path on both sides of the road with buffers to separate non-motorized traffic. The project is anticipated to positively influence community values, public health, and economic conditions.

CASE STUDY: EASTSIDE CLIMATE COLLABORATIVE

In 2019, the Transformative Climate Communities (TCC) Program, a grant program to fund community-led development and infrastructure projects to benefit the environment, health, and economy in California's most disadvantaged communities, awarded over \$9 million dollars to the City of Riverside and their partners. The Eastside Climate Collaborative project is designed to improve active and multimodal transportation options, develop an urban forest, and help residents reduce energy and water demand. It includes a 64-unit housing project, a protected bike lane, improved crosswalks, and a solar walkway between the housing project and transit stations. The project area is 72% census tracts that are in the top 10% of disadvantaged communities in California (identified by CalEnviroScreen.)

The California Statewide Housing Assessment (2018) predicts that housing growth will mainly occur in the Bay Area, Southern California, and Central Valley communities, which hold the majority of jobs in the state.⁵³ In addition, the state's Regional Housing Need Allocation (RHNA) process is used to determine future housing needs for each region of the state based on growth over a specific period of time. Local governments must develop a plan to accommodate the additional housing growth using the RHNA process. As new housing is built, land use policies and planning will influence the type and location of housing, with the goal of providing people with more affordable, convenient mobility options and better access to jobs and services. The location, density, and affordability of future housing will dictate much of our future travel patterns, and our ability to achieve our vision for 2050.

Our People and Households

Challenges

- ▶ **An aging population** means changing mobility needs for older adult populations.
- ▶ **Growing wealth gap** that leads to disparities in housing, employment, transportation, and health.
- ▶ **Environmental justice** concerns related in heightened exposure to air pollution and traffic incidents in low-income communities and communities of color
- ▶ **The jobs-housing imbalance** is causing longer and most costly commutes.
- ▶ **Affordable housing shortages** are forcing Californians to live further from jobs, goods, and services.
- ▶ **Gentrification and displacement** that uproot low-income communities and communities of color from long-time neighborhoods.
- ▶ **Rising homelessness** and lack of access to safe and affordable housing options.

Opportunities

- ▶ **Better integration of transportation and land use** to support improved access to affordable, low-carbon modes of transportation.
- ▶ **Aggressive regional targets** for long-term housing production.
- ▶ **Strong local and regional leadership** to advance social equity and environmental justice.
- ▶ **Anti-displacement measures** to protect those at risk of displacement.
- ▶ **New technologies** that reduce freight-related pollutants and other factors impacting community health.

OUR ECONOMY

California is a global economic powerhouse, with a gross state product (GSP) of \$3.2 trillion in 2019—larger than that of France, India, or the United Kingdom.⁵⁴ The Los Angeles Area and the Bay Area are the second and third largest urban economies in the U.S. after New York, with economies of \$1.3 trillion and \$1 trillion respectively.⁵⁵ In addition, three of the world's 10 largest companies are located in California,⁵⁶ with major industries such as tourism, entertainment, technology, and agriculture. California's economic success is due in part to a robust transportation network that supports thousands of jobs, enables access to jobs, goods, and services, and ensures that goods can move efficiently between businesses, residents, and the global marketplace.

Our Workforce

California's workforce is its economic engine. Providing workers with safe, reliable, and affordable mobility options is fundamental to supporting economic growth, particularly as we recover from the economic recession caused by COVID-19. The transportation sector is also a job generator itself, with 1.2 million jobs in transportation and material moving occupations in 2018—not to mention supporting engineering and construction jobs.⁵⁷ As California transitions to a low-carbon economy, opportunities arise to put Californians back to work in a way that advances social equity while supporting our statewide climate goals. These are addressed in Chapter 5.

Today. Like many other states, California's workforce was hit hard by COVID-19, which caused unemployment to soar to a record 25 percent in the weeks following stay-at-home policies.⁵⁸ Employment as of April, 2020 was 15 million, compared to 17.4 million at the end of 2017.⁵⁹ Total levels of employment, as well as the type and location of jobs, impacts transportation by dictating how many people are commuting on the system, and what their travel needs are. However, recent shifts to telework show that employment and commuting are no longer as closely linked. Workers may choose to live further from their jobs if telework becomes a permanent fixture for California businesses. Yet the two-thirds of California workers who must commute—primarily low- and middle-income workers—will continue to face the challenges of the jobs-housing imbalance and lack of mobility options connecting workers to their place of employment.

While employment growth was steady across sectors through 2019, income growth was not. Income in professional sectors such as finance, technology, and management grew by 26 percent between 2010 and 2017, while industrial jobs in construction, manufacturing, and trade increased by only one percent during the same period.⁶⁰ Moreover, industrial jobs make up more than half of jobs in rural areas, compared to only 20 percent in urban areas.

Economic Benefits of Transportation: SB 1

The White House Council of Economic Advisors found that every \$1 billion invested in transportation infrastructure supports 13,000 jobs a year. California SB 1 invests \$54 billion over the next decade to fix roads, freeways, and bridges across California, and includes funding for transit, active transportation, and workforce development. In addition to making transportation more safe and reliable, SB 1 investments will boost economic growth by creating jobs throughout the state.

Source: <http://rebuildingca.ca.gov/overview.html>

This trend highlights the growing income inequality within California communities and between urban and rural areas, which may be exacerbated by the growing digital divide. It is expected that income disparities will rise following high unemployment and the economic recession caused by COVID-19.

BY 2050. Over the long-term, statewide employment is expected to grow by 37 percent by 2050, to 23 million jobs.⁶¹ The Sacramento Region, Inland Empire, and San Joaquin Valley are expected to experience the highest rate of job and population growth, with urban areas retaining most of the state's jobs. Health and personal care jobs are predicted to grow faster than any other sector, at about 20 percent by 2026, due to the increased share of older adults who will require care.⁶²

At the national level, America's workforce is experiencing drastic changes as "baby boomers" continue to retire. Seventy million people are estimated to retire in the U.S. in the next decade, which will have profound impacts on industries and economies throughout the country.⁶³ To accommodate these shifts, some companies are implementing retention and succession planning, as well as additional incentive strategies, such as job-sharing, flex-time, telecommuting, and part-time work. At the same time, an increasing number of Californians are participating in the gig-economy, where workers use online platforms to provide on-demand services such as transportation, food delivery, and other delivery services. These jobs have potential to change travel patterns in California cities as flexible work schedules no longer require workers to travel during peak commute hours. Trends in automation and reshoring will also have drastic implications for job growth, wages, workforce training, and education by 2050.

Our Industries

TODAY. Before COVID-19, California's economy grew at about three percent per year—faster than any other state.⁶⁴ California's economy is made up of a diverse set of industries—from technology, to aerospace, to tourism, agriculture, and entertainment—all of which have unique transportation needs. Freight-intensive sectors, such as manufacturing, construction, trade, and utilities that rely directly on the transportation system to move goods make up about a third of our GSP.⁶⁵ Service and professional sector industries such as technology, finance, education, and health care, which make up the remainder of GSP, rely on the transportation system for shipments and deliveries, and to keep commuters moving safely and efficiently. COVID-19 perhaps had the most dramatic impact on some of California's most predominant industries: tourism, education, commerce, and retail—including small business. Transportation investments that help attract and retain a mix of industries and businesses in California will be essential to our recovery and economic growth over the long-term.

BY 2050. A recent study from the University of California (Los Angeles) predicts that it will take three years for the national economy to recover from the economic recession caused by COVID-19, and that California's recovery will follow a similar trajectory.⁶⁶ As the state's long-range transportation plan, the CTP 2050 must account for long-term growth and potential changes to the economy, despite uncertainty about how future pandemics, climate change, and other disruptions will impact economic growth. Before COVID-19, California's fastest growing industries included health care, construction, technology and information, hospitality, and agriculture. Providing transportation infrastructure, housing options, and workforce training opportunities to support growth in these and other emerging industries will be critical to continued economic growth.

INDUSTRY SPOTLIGHT

Agriculture: About 12 percent of total U.S. agricultural production comes from California, accounting for 1.2 percent of GSP. The Central Valley and Central Coast are the state's largest agricultural producers, shipping crops to all 49 U.S. states and 150 countries around the globe. With trucking accounting for 92 percent of fresh produce shipments, efficiency and reliability on California's highways are critical to the growth and global competitiveness of the agricultural sector.

Information and Technology: Silicon Valley is the undisputed global leader of technological innovation, driving an estimated 20 percent of California's GSP. Growth in information and technology is linked to growth in computer and electronics manufacturing, which has specific supply-chain needs such as time-sensitive air travel. Many technology companies are located in California due to the highly educated workforce.

Tourism: California is an international travel destination, hosting more than 268 million annual visitors before COVID-19. Yosemite National Park, Disneyland, and the Golden Gate Bridge are some of the state's top attractions. Getting to and from these places requires easily navigable, affordable, and accessible transportation options.

Our Economy and Transportation

Challenges

- ▶ **COVID-19 response** and recovery on the transportation system.
- ▶ **Economic inequality** may be exacerbated by the digital divide and limited access to jobs, goods, services, and education in disadvantaged communities.
- ▶ **Growing congestion** is leading to delay and inefficiencies in goods movement, and causing commuters to spend more time in traffic.
- ▶ **Declining fuel tax revenues** as we shift towards electric vehicle use.
- ▶ **Growing disruptions** to supply chains due to pandemics, climate change, and other disruptions.

Opportunities

- ▶ **New transportation investments** that will lead to growth in construction and other related jobs, especially in the low-carbon economy.
- ▶ **Land use and development** policies that improve the jobs-housing balance and provide workers with more reliable and affordable mobility options.
- ▶ **Workforce training** programs to prepare California workers for a new economy.
- ▶ **California's position** as a global innovation hub will help position the state as a driver of the new economy.

OUR MULTIMODAL SYSTEM

California has a robust and complex transportation system made up of roads, bridges, railways, ports, transit systems, bicycle and pedestrian paths, and other vital infrastructure that supports our communities and economy (Figure 12). This section provides a brief snapshot of today's multimodal transportation system, what it might look like by 2050, and the challenges and opportunities it may face along the way. While this section addresses each transportation element separately, our integrated system's value is far greater than the sum of its parts. That is why local, state, and regional agencies are increasingly taking a holistic approach to transportation planning, adopting Complete Streets plans and multimodal corridor plans to ensure that infrastructure is seamlessly integrated, well-connected, and supports all modes and users.

FIGURE 12 CALIFORNIA'S MULTIMODAL TRANSPORTATION SYSTEM

CALIFORNIA HAS:



The following sections explore infrastructure conditions by mode of transportation today, what conditions might look like by 2050 if current trends continue, the challenges associated with each mode, and the opportunities that might help each evolve to better serve the people of California.

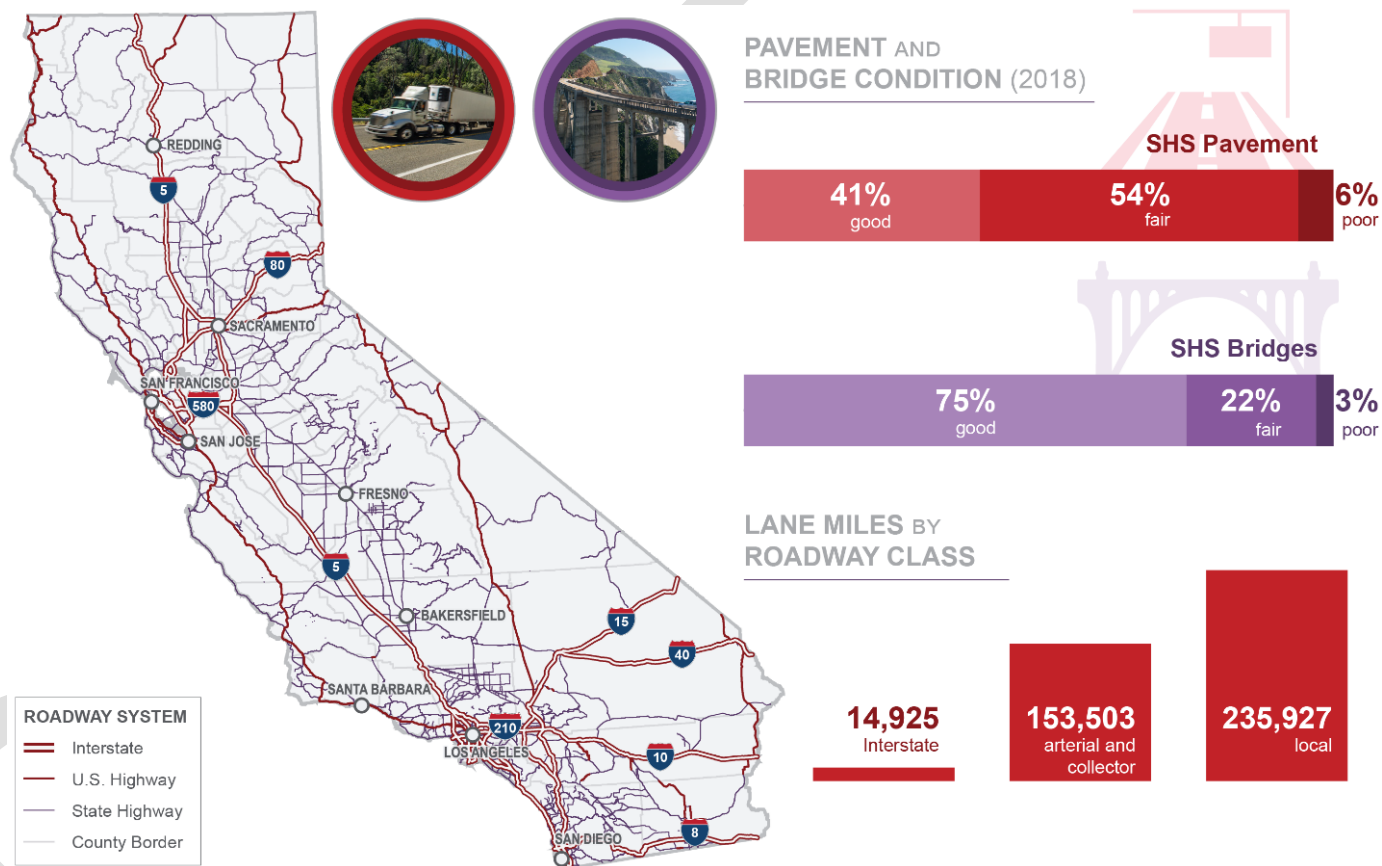
Roadways

California's roadways are the backbone of our multimodal transportation system. They support mobility for nearly 40 million residents and 268 million annual visitors, and move more than \$4 trillion worth of goods to and from California's households, businesses, and more.⁶⁷ Maintaining our roadways in a state of good repair is absolutely essential to our quality of life and economic prosperity.

TODAY. California has nearly 400,000 lane miles of roadway throughout the state, second only to Texas. Our roadway system is made up of interstate highways, arterials and collector roads, and local roads that support local and regional travel needs. These arterials and local roads make up a majority of our roadway system (Figure 13).

The State Highway System (SHS), maintained by Caltrans, is comprised of more than 51,000 lane miles.⁶⁸ Beyond ensuring that the SHS remains in a state of good repair, the CTP 2050 must also address the needs of local and regional roadways that are just as critical to our communities and economy.

FIGURE 13 ROADWAYS TODAY



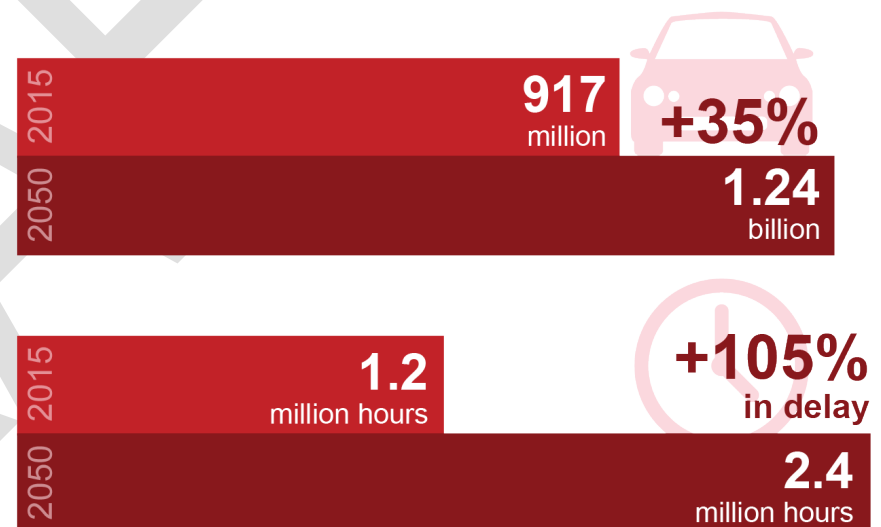
Source: Pavement and bridge condition from the 2018 Transportation Asset Management Plan; Lane Miles by Roadway Class from the 2018 Highway Performance Monitoring System.

Between 2001 and 2017, auto travel on California’s roadways increased by 14 percent, leading to growing traffic congestion, delay, and rising emissions.⁶⁹ Travel increases as our population grows, and also as people live farther from jobs, school, shopping, and recreation—which requires them to travel longer distances. SB 743 requires that new developments mitigate increased VMT per capita, VMT per employee, and net VMT. This law is intended to more appropriately balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of GHG emissions. Through much of our state’s history, we have expanded roadway capacity to accommodate growing demand for travel. However, numerous studies show that expanding roadway capacity leads to “induced demand”—additional traffic created simply by building roads. CTP 2050 stakeholders agreed that California should explore alternative ways to use our existing roadway capacity more efficiently before considering expansion, and this priority is integrated into the CTP 2050 recommendations..

Increased demand for vehicle travel, paired with the worsening impacts of climate change, has also put additional wear and tear on our roads. Fifty-one percent of major urban roads are in poor condition, and six percent of bridges are considered structurally deficient.⁷⁰ We are already taking action to improve the condition of our roadways. SB 1 invests \$1.5 billion in local roads, \$1.8 billion in the SHS, and \$400 million in bridges and culverts to address a backlog of repairs, modernize the system, and ensure a cleaner and more sustainable road network in the future.

BY 2050. If current trends continue, driving will remain the dominant mode of transportation in 2050. With anticipated increases in VMT of up to 35 percent by 2050, California’s roads and bridges will likely face further congestion and deterioration if sufficient system investments are not made.⁷¹ Climate change and natural disasters will pose further risks to our roadways, requiring even more maintenance, rehabilitation, and resources to keep assets in a state of good repair, and to keep users safe. By continuing a “fix-it-first” approach, integrating sustainable pavements and other materials, and using new tools and technologies to efficiently manage assets as recommended in California’s Transportation Asset Management Plan (TAMP), we can extend the life of the multimodal system while making travel more efficient and reliable.

FIGURE 14 ROADWAYS BY 2050



Source: CSF2TDM.

Our Roadway System

Challenges

- ▶ **Traffic fatalities and serious injuries** on the transportation system, as more than 3,500 people are killed on California's roads each year.⁷²
- ▶ **Growing travel demand** as new drivers on the road in 2050 add to congestion, emissions, safety concerns, and maintenance needs.
- ▶ **Congestion and delay** on California's roadways are among the worst in the nation, costing California residents a total of \$28 billion in wasted fuel and lost time each year.⁷³
- ▶ **Induced demand** that requires us to accommodate growing demand primarily within the footprint of our existing roadway system.
- ▶ **Climate change** is leading to growing frequency of fires, floods, sea level rise, and other natural disasters that put our infrastructure at risk.
- ▶ **Rising costs** of maintenance and rehabilitation associated with aging infrastructure.

Opportunities

- ▶ **Travel Demand Management Strategies (TDM)** that expand non-auto options can reduce the number of vehicles on the road, lowering the wear and tear on our roadways by 2050.
- ▶ **Reprioritizing** existing right-of-way to better accommodate multimodal travel.
- ▶ **Intelligent transportation systems (ITS)** can support deployment of CAVs, leading to more efficient use of our roadway system.
- ▶ **New tools and technologies** can advance modeling, simulation, and data collection and monitoring tools can help manage multimodal assets more efficiently.
- ▶ **Expanded broadband** within the existing highway right-of-way can help increase internet access and help close the digital divide.

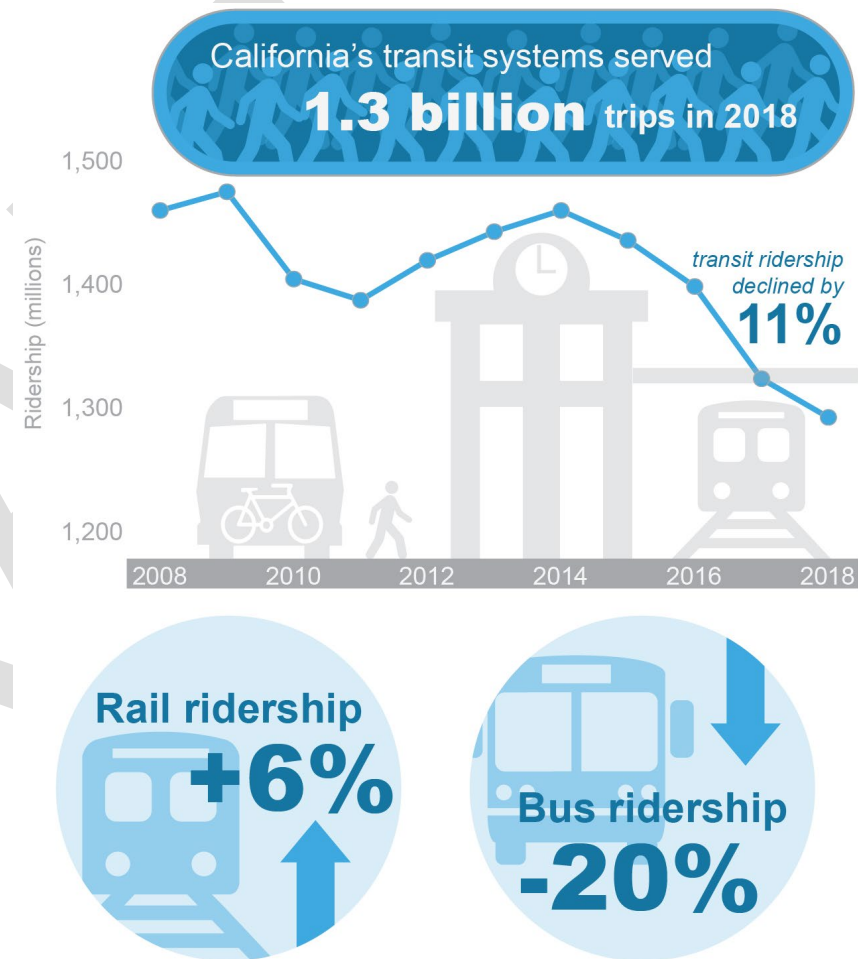
Public Transportation

Public transportation plays a vital role in California's transportation system by providing millions of residents with access to work, school, shopping, and services. California's more than 200 public transit systems are made up of buses, trains, ferries, shuttles, vanpools, on-demand services, and much more. These systems stimulate local economic growth and help reduce congestion and GHG emissions by providing an affordable alternative to driving. By improving transit system, and access to transit, we can improve health, quality of life, and access to opportunity across California communities.

TODAY. Before the onset of COVID-19, which led to significant declines in transit ridership across the state as a result of stay-at-home policies, California ranked 7th out of 50 states in transit ridership, with about 1.3 billion transit trips in 2018.⁷⁴ But like most other U.S. states, California transit ridership was already in decline pre-COVID-19—with an 11 percent drop between 2008 and 2018.⁷⁵ The recent economic downturn left agencies to cope with rising operational costs and diminished revenue sources, while still needing to provide service to people who rely on transit to access work and essential services—predominately low-income people and people of color. Transit agencies are now being forced to rethink how transit operates in our communities, and to ensure that it remains a convenient, reliable, and affordable mobility option.

BY 2050. As our economy recovers, travel may return to pre-COVID-19 levels, and demand for transit may increase as it becomes safe to be in proximity to others. An analysis of future travel conducted before COVID-19 suggests that transit ridership could increase by up to 56 percent between 2015 and 2050, if current plans such as the California State Rail Plan, Statewide Transit Strategic Plan, and High-Speed Rail Business Plan are implemented. These statewide plans call for new regional rail system connections, improved service frequency and capacity, and dedicated

FIGURE 15 PUBLIC TRANSPORTATION TODAY



Source: National Transit Database, Time Series Data (2018).

FIGURE 16 PUBLIC TRANSPORTATION BY 2050



Source: Transit ridership forecasts are from the CSF2TDM, 2019.

freight rail capacity to improve passenger rail service. At the same time, the California Integrated Travel Project (Cal-ITP) is spearheading an initiative to develop a statewide trip planning and payment system that will make transit travel simpler and more affordable by allowing users to combine routing, booking, and payment within one platform.

At the local level, many transit agencies are expanding light rail systems, developing bus rapid transit and express bus lanes, and transit ITS solutions that will improve service efficiency and reliability. Paired with even further advancements in micromobility, Mobility as a Service (MaaS), and active transportation investments, transit could be the mode of choice for many more Californians by 2050.

High-Speed Rail

When complete, California's high-speed rail system will span from Sacramento and San Francisco to San Diego, connecting 24 stations. At train speeds of over 200 miles per hour, high-speed rail would provide a competitive, low-emission alternative to intercity air and auto travel.

LEGISLATIVE CASE STUDY: INNOVATIVE CLEAN TRANSIT

The California Air Resources Board (CARB) approved the Innovative Clean Transit regulation in 2018, a first-of-its kind regulation in the U.S. The regulation sets a statewide goal for California's public transit agencies to transition to an all zero-emission bus fleet by 2040. When fully implemented, the Innovative Clean Transit regulation is expected to reduce GHG emissions by 19 million metric tons from 2020 to 2050—the equivalent of taking four million cars off the road. Through this regulation, California's public transit agencies will continue to play a pivotal role in meeting the state's air quality and climate goals.

Our Transit and Rail Systems

Challenges

- ▶ **Providing equitable service** under significant cost constraints and counter displacement and gentrification.
- ▶ **Maintaining safety and sanitation** on vehicles to protect workers and passengers.
- ▶ **Declining ridership** both nationwide and in California.
- ▶ **Declining fare revenues** due to declining ridership.
- ▶ **Sparse land use** that makes it difficult to provide efficient transit service in exurban and rural communities.
- ▶ **Core capacity constraints** due to growing urban populations, particularly in the Bay Area and Los Angeles.
- ▶ **Modal connectivity barriers**, both physical and logistically, that continue to make transit an infeasible option for many Californians.

Opportunities

- ▶ **Seamless integration** of transit modes, routing, booking, and payment (as being explored through Cal-ITP) can reduce the uncertainty of end-to-end transit travel and improve convenience.
- ▶ **Interlining** connected routes between transit, traditional rail, and HSR can increase efficiency between modal connections and enable improved interregional transit travel.
- ▶ **Dedicated right-of-way** for transit vehicles (e.g., bus rapid transit) can improve the reliability and convenience of transit.
- ▶ **Transit ITS** such as transit signal priority, automatic passenger counters, and real-time traveler information systems can make transit a more efficient and reliable option.
- ▶ **First-last mile** investments that can expand access to transit.
- ▶ **MaaS** options that can connect people to traditional bus and rail transit systems.
- ▶ **Transit-oriented development (TOD)**, particularly in urban and suburban areas, can make transit trips more attractive and competitive with auto travel for more Californians.

Active Transportation

Active transportation such as walking and bicycling offer a clean and affordable alternative to the private automobile and play a vital role in improving public health, quality of life, and environmental sustainability in our communities. Caltrans Deputy Directive 64-R2 requires Caltrans to implement “complete streets” that provide for the needs of travelers of all ages and abilities in all planning, programming, design, construction, operations, and maintenance activities and products on the State Highway System.” Paired with extensive efforts to expand complete streets at the local and regional efforts, this directive helps ensure that Californians have safer and more convenient access to active transportation options.

TODAY. In 2015, Californians took more than 13 million trips by biking or walking, making up nearly eight percent of total travel.⁷⁶ Commuting by active modes has been slowly increasing since 2006, with about four percent of commuters now biking or walking to work.⁷⁷ The rapid expansion of bike sharing programs starting in 2010 has contributed to the increase by providing residents with flexible, low-cost access to biking. E-bikes, which require less effort than a traditional bicycle and provide more range, area also contributing to growth. U.S. e-bike sales grew by 90 percent in the first quarter of 2019 compared to the previous year.⁷⁸

What is a Complete Street?

A complete street is a transportation facility that is planned, designed, operated, and maintained to provide safe mobility for all users, including bicyclists, pedestrians, transit vehicles, truckers, and motorists, appropriate to the function and context of the facility. Every complete street looks different, according to its context, community preferences, the types of road users, and heir needs.

Boosting Biking and Walking: Local and Regional Efforts

California cities, counties and MPOs are leading the charge to advance active transportation options in our communities:

- ▶ Nearly 60% of cities and 80% of counties have completed Active Transportation Plans.
- ▶ 11 cities have adopted Vision Zero campaigns that aim for zero bicycle and pedestrian fatalities.
- ▶ 17 cities have launched bike-share systems, making biking more accessible to residents and visitors.

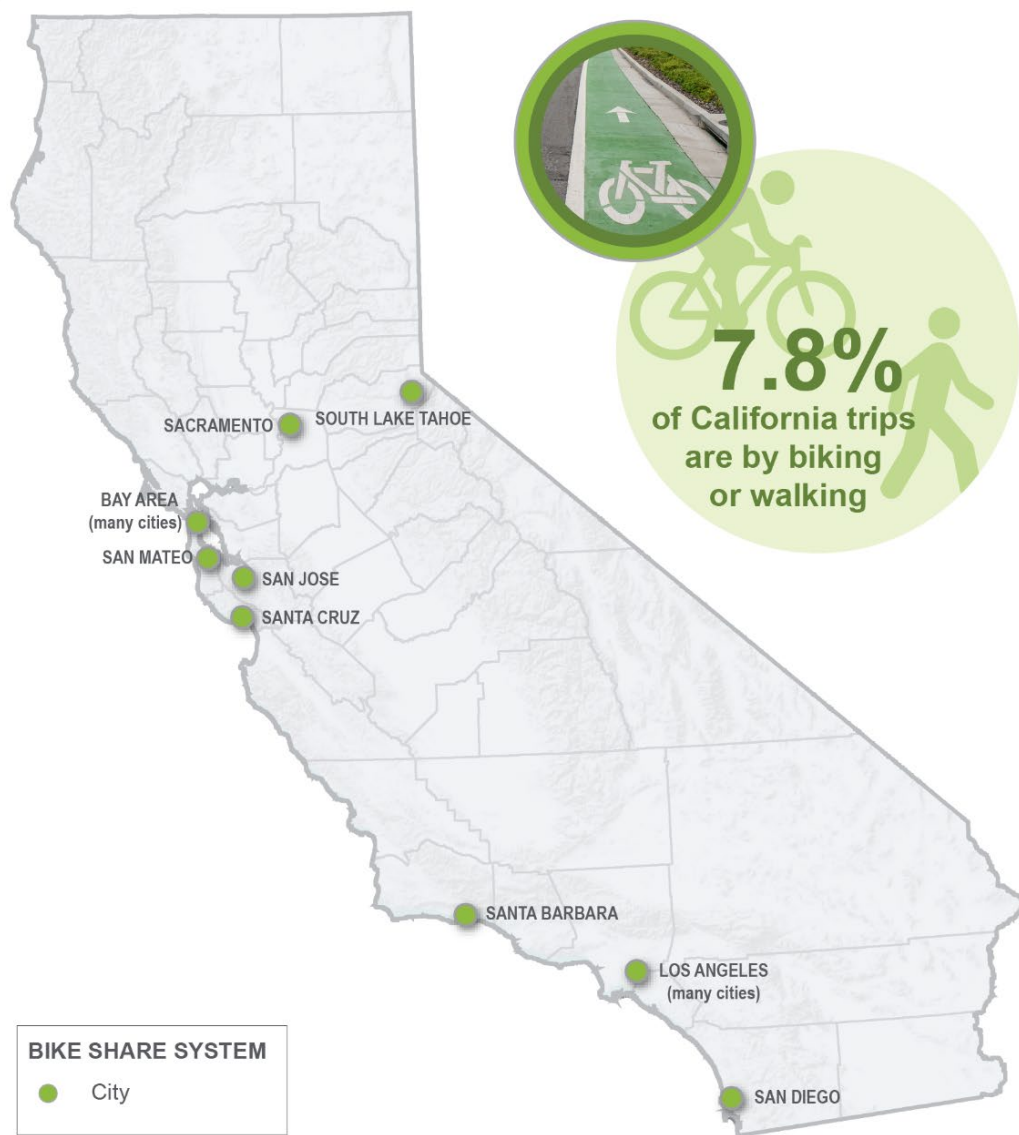
As discussed in Chapter 1, biking and walking skyrocketed in many California neighborhoods following the spread of COVID-19, primarily for recreational purposes, but also for essential travel. Many cities implemented “Slow Streets” programs to provide people with more space to bike and walk, while still keeping physically distant. Building on these recent shifts, as well as long-standing efforts to expand dedicated bike infrastructure, complete streets improvements, wayfinding, and other solutions that make biking and walking more inviting will require sustained levels of investment, coordination, and collaboration at the state, local, and regional level. SB 743 and the Caltrans Strategic Management Plan further reinforce active transportation as an alternative to vehicle use to reach long-term goals.

LOCAL SPOTLIGHT: OAKLAND SLOW STREETS PROGRAM

During COVID-19 stay-at-home orders, the City of Oakland designated 74 miles of neighborhood streets as "slow streets." The designation closes several streets to through vehicular traffic, lending more space to bikes, pedestrians, wheelchair users, and local vehicles only. Oakland's Slow Streets Program enhances public health and safety by introducing space for physical distancing, reducing crowding on parks and trails, and providing more space for recreation and active travel.

To make biking and walking safer and more desirable options, California has made active transportation investments a top priority. The first statewide plan to address active transportation, *Toward an Active California*, was developed in 2017, and California has committed \$1 billion in Active Transportation Program (ATP) funding (an increase of 80 percent) through SB 1. This funding comes with a commitment to advance equity in active transportation by providing options that meet the needs of Californians regardless of age, race, ethnicity, national origin, gender, sexual orientation, ability, or income.

FIGURE 17 ACTIVE TRANSPORTATION TODAY



BICYCLE MILES (SCAG, MTC, AND SANDAG MPOs)



Source: Biking and walking estimates are from the CSF2TDM. Bicycle miles are from Toward an Active CA.

BY 2050. If current trends continue, bicycle and pedestrian travel could increase by 45 percent by 2050, totaling nearly 18 million daily trips. Although a significant increase in total biking and walking trips, this figure only represents a half percent mode shift away from auto use.⁷⁹ If we are to achieve our climate goals and improve public health and quality of life in California communities, we must do more to make active transportation a viable and competitive mode of transportation. Committed investments described in the previous section suggest that we are heading in the right direction. But there are even more opportunities to support people in shifting to active travel. E-bikes as well as dockless mobility such as bikes and scooters are making active transportation accessible to people who might never have considered it an option, and the spike in usage is increasing awareness of the need for safe and connected infrastructure. Given intensive local and regional efforts to boost active transportation paired with new technologies and service models, active transportation systems of tomorrow could offer a safe, healthy, and viable mode of transportation that is affordable and accessible to many more Californians.

FIGURE 18 ACTIVE TRANSPORTATION BY 2050



Source: CSF2TDM.

CASE STUDY: CALIFORNIA COASTAL TRAIL

The vision for the California Coastal Trail (CCT) is a continuous interconnected public trail system along the California coastline. It is designed to foster appreciation and stewardship of the scenic and natural resources of the coast and serves to promote active travel. The Trail system is to be located on a variety of terrains, including the beach, bluff edge, hillsides providing scenic views, and within the highway right-of-way. It may take many forms, including informal footpaths, paved sidewalks, and separated bicycle paths. When no other alternative exists, it sometimes connects along the shoulder of the road. While primarily for pedestrians, the CCT also accommodates bicyclists, wheelchair users, equestrians, and others as opportunities allow. Of the 1,250 miles of coastline, about 50% of the CCT is complete and is being used by thousands of people every day.

Our Active Transportation System

Challenges

- ▶ **Personal safety** remains a deterrent to widespread active travel. In many communities there are higher traffic risks where travelers do not have access to sidewalks, bike lanes, and other protections from motor vehicles.
- ▶ **Lack of connectivity**—a safe active corridor is as good as its weakest link. Even small gaps in connectivity can be a significant deterrent to walking or biking.
- ▶ **Poor sidewalk and roadway conditions** increase safety risks and deter travel.

Opportunities

- ▶ **Separated bikeways** and multi-use paths can protect users from fast-moving vehicles.
- ▶ **E-bikes** and scooters can extend trip ranges, and require less physical energy, making active transportation more desirable.
- ▶ **Shared, dockless mobility** options are expanding active transportation convenience and affordability.
- ▶ **Slow streets programs** are setting the stage for cities to provide more space for people biking and walking.

Airports

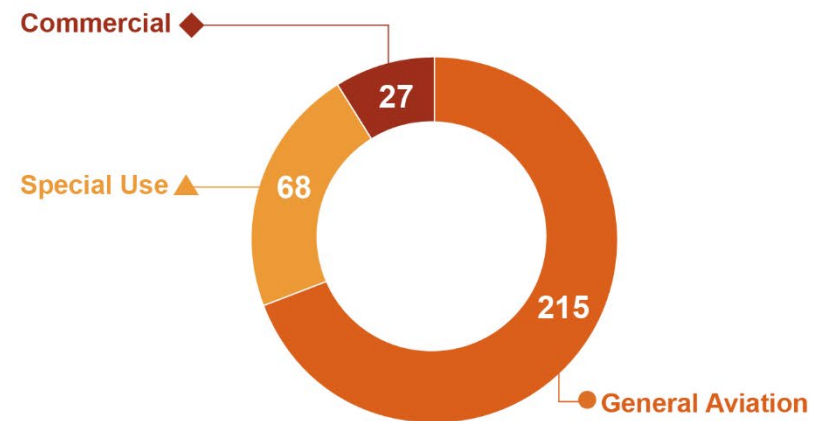
California's airports are job centers and trade hubs, serving both freight and passenger transportation. While Caltrans does not own any airports and is not responsible for managing airport operations, Caltrans plays an important role in integrating aviation into the broader context of multimodal transportation planning and improving connectivity between people, communities, and the global market. These goals are met through Caltrans aviation system planning and land use compatibility programs, which ensure ground and airspace safety standards are met, quality access in and out of airports is provided, and potential impacts to surrounding land uses are minimized.

TODAY. Prior to COVID-19, which caused nationwide enplanements to decline 93 percent, California's airports welcomed over 227 million passengers and moved 4.8 million tons of air-cargo annually.⁸⁰ Los Angeles International—California's busiest airport—recorded over 44 million enplanements per year,⁸¹ followed by San Francisco International and San Diego International.⁸² In addition to passenger travel, California's more than 300 airports support the movement of goods to and from domestic and international markets. Air cargo is typically high-value, and therefore time-sensitive. With growth in high-value goods passing through California, all but two of California's largest cargo-moving airports experienced growth between 2013 and 2018.⁸³ Shifts to trucking, competition with other domestic airports, manufacturing shifts from Asia back to North America, and the Panama Canal expansion all will impact future demand for air cargo.⁸⁴

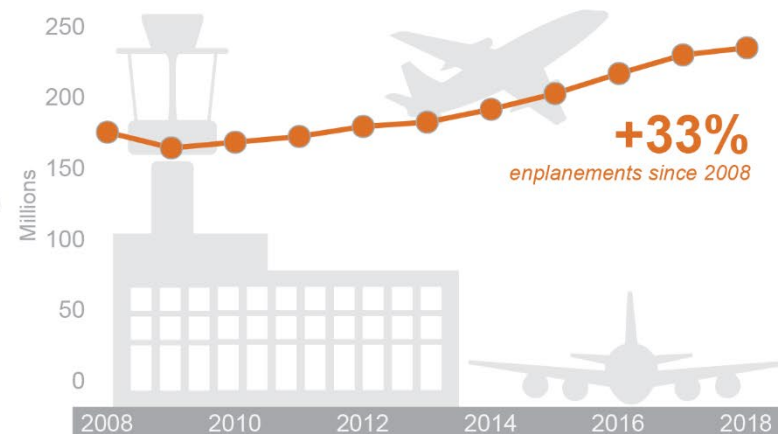
FIGURE 19 AIRPORTS TODAY



AIRPORTS (2016)



PASSENGER ENPLANEMENTS



Source: Passenger enplanements from the Federal Aviation Administration Passenger Boarding and All-Cargo Data for U.S. Airports.

BY 2050. As the economy recovers and interregional travel and tourism begin to rise, California's airports will become increasingly vital elements of the state's multimodal transportation system. California's Aviation System Plan is focused on enhancing future connectivity between air travel and other modes, improving airport access in small and rural communities, and expanding sustainable energy solutions to curb aviation-related emissions.

Our Airports

Challenges

- ▶ **Limited capacity** at many airports may not be able to accommodate long-term forecasted growth in demand.
- ▶ **Carbon footprint** for planes has improved over the years, improvements are still needed; although planes contribute a large share of emissions to the environment, they are vital to our economy and livelihood.
- ▶ **Unmanned Aerial Vehicles (UAV)** driven by increasing consumer and industrial demand, may result in operational and safety issues related to airspace management.

Opportunities

- ▶ **More efficient goods movement** as aviation provides a high-speed mode of transportation for high-value goods.
- ▶ **Shifting short-haul air** travel within the State to High-Speed Rail.
- ▶ **Improved connectivity** by increasing accessibility to emergency response and evacuation lifelines as air travel is often one of the most viable modes of transportation to rural areas of the state.
- ▶ **New technology** options such as electric and hybrid jet engines could reduce emissions and fuel consumption in the aviation industry.
- ▶ **Improved airport-land use planning** that incorporates airports as regional economic and transportation hubs.

Goods Movement

California is home to one of the nation's most critical freight networks that links some of the largest U.S. port complexes with markets in and around the state and the rest of the country. The multimodal freight system drives California's economy, supporting a broad range of commercial and industrial activities. Our ability to keep businesses running, workers commuting, and goods moving throughout the state is based on the reliability of our freight rail, trucking, airports, seaports, international ports of entry (POE), maritime facilities, intermodal facilities, and other goods movement infrastructure.

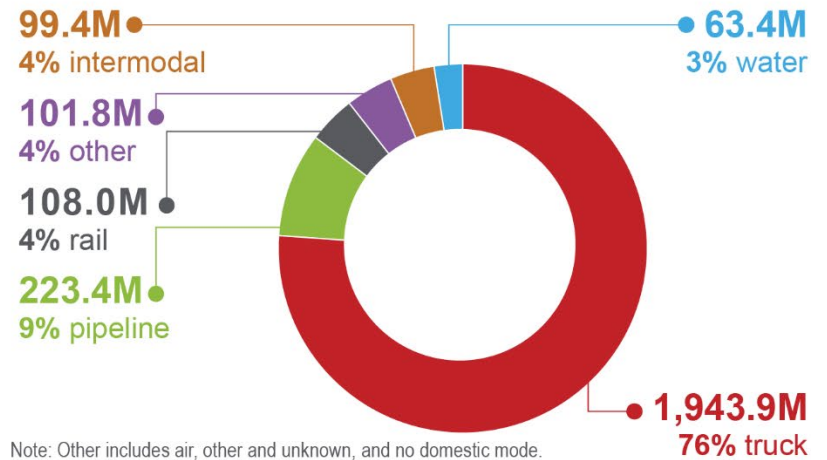
The COVID-19 pandemic, which disrupted critical global supply chains, highlighted the vital function of our freight infrastructure, and the need for increased resiliency of our goods movement system. Almost overnight, demand for food, medical and cleaning supplies, and small package home deliveries substantially increased. The smooth functioning of our complex freight system depends on a series of interconnected facilities working in concert with one another. These facilities are typically owned and operated by different public or private organizations. Extensive coordination and cooperation between these organizations, as well as state involvement in supply chains during major crises and disruptions, will be essential in supporting recovery, ensuring future economic resilience, and coping with fluctuations in the global economy in the coming years.

TODAY. California exported \$178 billion worth of goods in 2018, a value equal to 10.7 percent of the nation's overall exports, making it the second largest exporter behind Texas.⁸⁵ Approximately \$441 billion worth of goods, about 2.5 times greater than the value of exports, entered through California's transportation gateways in 2018.⁸⁶ Furthermore, more than 1.3 million people are employed in commercial and industrial activities, which are supported by California's freight network.⁸⁷ The freight network is composed of trucking routes, freight rail systems, ports and waterways, and intermodal connectors. Each are discussed in more detail in this section.

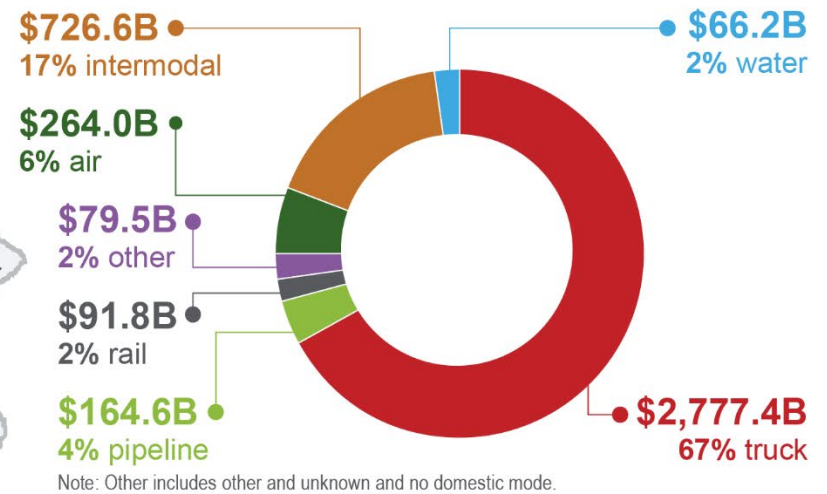
FIGURE 20 GOODS MOVEMENT TODAY



TONNAGE BY MODE (2018)



VALUE BY MODE (2018)



Source: Tonnage by mode and value from the Freight Analysis Framework (FAF) 4.

Trucking

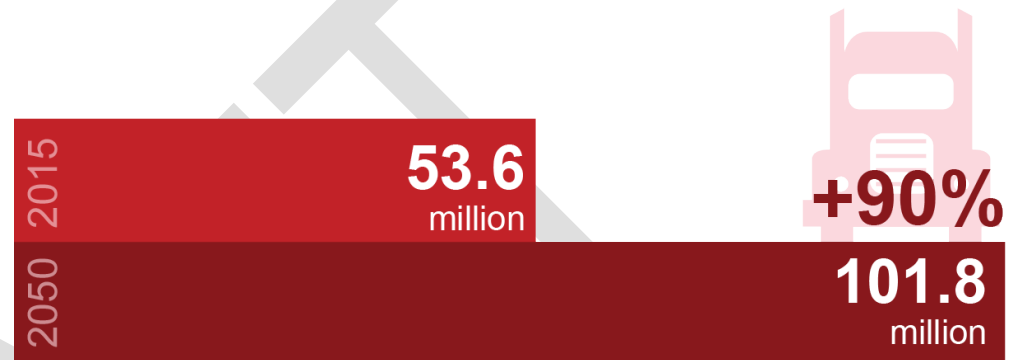
Trucking is the primary mover of freight in California, carrying about 3.8 million tons per day—88 percent of all manufactured tonnage in the state.⁸⁸ Nearly every commodity shipped to, from, or within California is transported by truck at some point in the supply chain. Even goods that are primarily transported on rail use trucking as a first- and last-mile connection to manufacturers and distributors.

Many of California's trucking facilities are on the National Highway Freight Network (NHFN), a strategic network of highways that are of critical importance to domestic and international trade.⁸⁹ Truck parking, alternative fueling locations, and weigh-in-motion (WIM) stations are also critical to the functioning of our freight system. California has one of the lowest rates of commercial vehicle parking spaces per truck travel, and is facing a severe truck parking shortage, specifically along the I-5 corridor. California also has seven of the Nation's top ten truck freight bottlenecks. Addressing freight capacity constraints is critical to keeping goods moving on our system and maintaining California's global economic competitiveness.

Rail

California's freight rail network supports the operations of industries throughout the state and links California with domestic, interregional, and international markets. Our freight rail system is comprised of two Class I railroads: BNSF and Union Pacific, and 26 short line railroads that connect to rail yards, warehousing, and distribution centers throughout the state. The rail network covers

FIGURE 21 TRUCK VMT BY 2050



Source: CSF2TDM.

CASE STUDY: PORT OF OAKLAND 7TH STREET GRADE SEPARATION PROJECT

The 7th Street Grade Separation Project will improve truck and rail access to the Port of Oakland, one of the busiest ports in the nation. The project provides regional and local benefits in the form of congestion relief, improved efficiency and economic competitiveness, reduced emissions, and safety improvements. The West grade crossing will improve traffic flow and reduce idling and related emissions. The East grade project realigns and reconstructs the exiting underpass and multi-use path for pedestrians and bicycles, minimizing conflicts between users. By improving access to the rail terminal and reducing truck delay, the project supports regional goods movement in the Bay Area and beyond.

over 6,500 miles of track across 29 different railroads.⁹⁰ In 2017, railroads handled 162.3 million tons of freight that originated in, terminated in, or moved through California.⁹¹

As roadway congestion increases, rail becomes an increasingly competitive way to move goods across the state. However, capacity limitations, poor last-mile access, at-grade crossings, and shared right-of-way with passenger trains all pose barriers to moving more freight by rail.

Intermodal Connectors

Intermodal connectors are critical to our freight system, as they provide access to the transloading of freight between multiple modes, minimizing handling and overall delay in goods movement. Access to and from these intermodal facilities is typically located along local roadways which connect to Interstate and State Highway freight corridors and serve as last-mile connections. While critical to our system, many of the environmental and community impacts from freight can be most prevalent along these local intermodal connectors.

Ports and Waterways

Seaports are California's freight gateways to the world. California has 12 deep-water seaports, including two inland ports that have access to the ocean via the Sacramento/San Joaquin Delta. California ports combined had a 46.7 to 49.2 percent share of the loaded U.S. import container trade in 2000 through 2010.⁹² The four largest deep-water seaports in California are Los Angeles, Long Beach, Oakland, and San Diego, all of which are included within the top 50 U.S. Containership Ports in 2016. Stockton and West Sacramento are home to inland ports, which are located on smaller bodies of water.

The Environmental Impact of Goods Movement

Our robust freight system brings significant benefits to communities, regions, and the state. It also comes with substantial costs, including increased emissions, noise, energy consumption, and ecological degradation. In 2015, truck travel accounted for less than one percent of total trips, but six percent of statewide VMT—and a proportionally higher share of emissions. Fuels used by aircrafts, heavy-duty trucks, and ocean-going vessels produce much higher emissions than unleaded fuel. Pollution attributed to freight-related sources are linked to numerous health and environmental problems, which are elevated in low-income communities and communities of color. Reducing non-exhaust particulate matter such as brake, tire, and road wear and dust, are also crucial to reducing environmental impacts of the freight sector. We also must continue to incorporate green products and materials in roadway construction and maintenance activities.

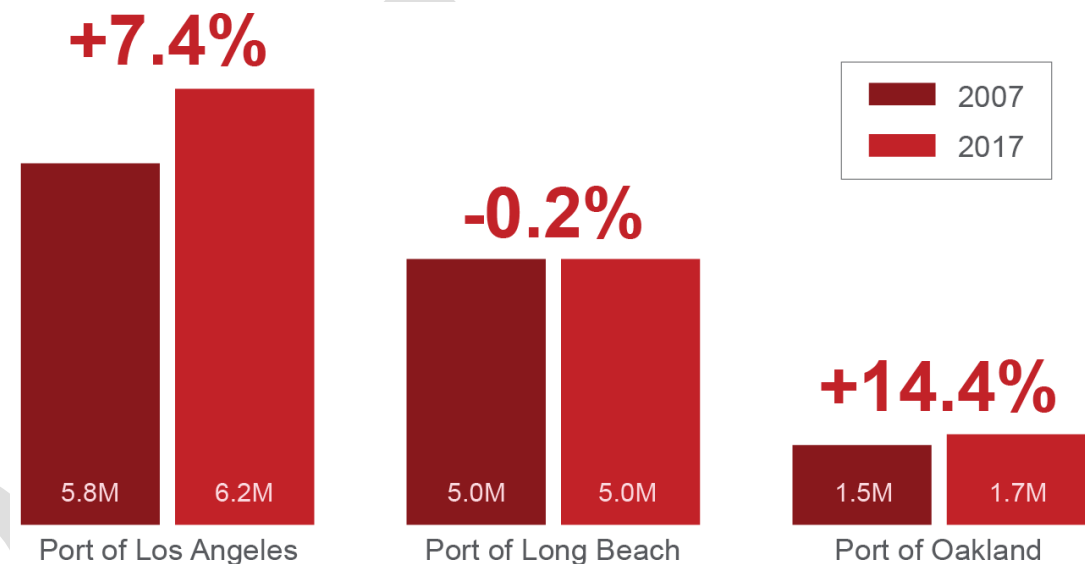
International Ports of Entry (POE)

California and Mexico share over 130 miles of international border. The two main freight gateways connecting California and Mexico are the Otay Mesa POE in San Diego County and the Calexico East POE in Imperial County. These are critical to supporting trade with Mexico, which was California's top trading partner and the U.S.'s second largest trading partner in 2018.⁹³ Alleviating congestion and delay along our POEs is critical to supporting economic growth and minimizing the negative environmental impacts of goods movement.

By 2050. As California's population grows, so will demand for goods. International growth will also increase demand for California goods, putting additional pressure on the freight system. By 2050, truck trips are expected to increase by 40 percent.⁹⁴ This equates to an increase in truck VMT of 90 percent. Without intervention, this will have significant implications for our ability to reach our 2050 emissions targets and the CTP's other goals of accessibility, safety, equity, and quality of life.

The CFMP and Sustainable Freight Action Plan outline bold visions for where our freight system needs to be by 2050 to support economy vitality while addressing environmental issues. The four themes identified in the CFMP are: improving port access reliability; border efficiency; inter and intrastate freight movement and resiliency; and sustainability and innovations. Opportunities to improve our freight systems include autonomous trucking and platooning, which could significantly improve freight operations and capacity; advancements in freight intelligent transportation systems (ITS); zero-emission trucks; and alternative last-mile deliveries such as drones, bike couriers, and other automated delivery technologies that reduce truck traffic on local roads.

FIGURE 22 PORT VOLUMES (TEUS) FOR 3 LARGEST PORTS



Source: U.S. Department of Transportation Maritime Administration. U.S. Waterborne Foreign Container Trade by U.S. Customs Ports (2000 – 2017). Total Trade (Imports and Exports) in Twenty-Foot Equivalent Units (TEUs)

Our Freight System

Challenges

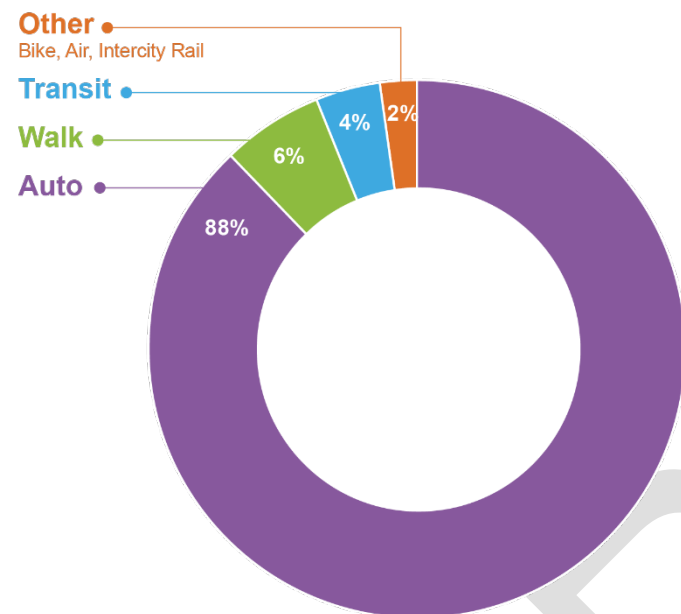
- ▶ **Global trade fluctuation** will impact California's long-term economic stability.
- ▶ **Centralized responsiveness** to natural hazards and crises such as COVID-19, as the elements of the freight system are owned and operated by numerous different players.
- ▶ **Projected growth** in tonnage moved by 2050 means significant additional strain on goods movement infrastructure.
- ▶ **GHG emissions** from freight vehicles are significantly higher than other sources of travel.
- ▶ **Heightened exposure to freight-related pollution** in low-income communities and communities of color.
- ▶ **Truck parking shortages**, as a result of California's low rates of commercial vehicle parking spaces pose significant challenges, specifically along the I-5 corridor.
- ▶ **Last-mile connectivity** is a growing concern as ecommerce and same- and next-day deliveries put additional stress on last-mile connectors, many of which are not designed to accommodate large truck volumes.
- ▶ **Freight bottlenecks**, of which seven of the nation's top ten are in California, are causing congestion and delay that lead to increased emissions.

Opportunities

- ▶ **Autonomous trucks and platooning** could significantly improve freight operations and capacity by reducing variability in errors, increasing safety, and decreasing travel times and fuel usage.
- ▶ **Freight intelligent transportation systems (ITS)** could improve the reliability of goods movement on California roads.
- ▶ **Clean freight technologies** could have enormous potential to curb freight-related pollution.
- ▶ **Underutilized freight rail capacity** can help move goods more efficiently.
- ▶ **Alternative last-mile deliveries** such as drones, bicycle couriers, and other automated delivery technologies can reduce the need for last-mile deliveries.

OUR TRAVEL PATTERNS

FIGURE 23 MODE SHARE (2015)



Source: CSF2TDM.

based on where they live, where they work, how safe they feel, how far they are traveling, and the cost of each option, among other factors. In 2015, Californians used an auto for 88 percent of all travel in the state. In many communities, the automobile remains the only viable or convenient means of transportation available.

Vehicle Miles Traveled. How much we drive can be measured by VMT, an estimate of the total annual miles traveled by all vehicles in the state. Between 2001 and 2017, VMT grew by nearly 14 percent—about the same rate as population growth during this

As explored in the previous sections, shifts in demographics, land use and housing, economic growth, and the numerous opportunities and challenges facing our transportation infrastructure will all impact how people and goods travel by 2050. This section explores travel patterns in California today, and presents the potential cumulative impacts of these shifts by 2050, particularly on VMT, mode share, delay, and vehicle emissions.^{iv}

Today

The modes of travel we choose, the amount we travel, and the level of congestion on our roadways, all point to our continued reliance on vehicle travel, which remains the predominant mode of travel today. The following sections describe current and historic trends in each of these factors.

Mode Share. Mode share refers to the percentage of total statewide travel that occurs via car, bus, rail, plane, and other modes of transportation. People choose travel options

FIGURE 24 HISTORIC GROWTH IN VMT



Source: Highway Performance Monitoring System.

^{iv} The information reported reflects travel patterns before the onset of COVID-19, and the section “by 2050” is based on forecasts that were estimated before its impact.

period.⁹⁵ In 2015, Californians drove over 900 million miles, or 23.5 miles per person each day. Rising VMT means higher household travel costs, a greater risk of traffic crashes and fatalities, higher fuel consumption and worsening air quality, and more wear and tear on infrastructure. That's why reducing VMT is a core goal of the CTP 2050.

Delay. Delay refers to the additional time Californians are forced to spend in their vehicles due to traffic congestion, measured in annual vehicle hours of delay (VHD). In 2015, Californians spent more than one million hours sitting in traffic.⁹⁶ In 2017, it was estimated that the average California commuter spent more than 40 hours in delay annually. Congestion and delay increase the cost of transportation by requiring people to spend more money on fuel, and lose valuable time that could be spent with family, friends, recreating, or at work.

By 2050

How will travel change in California by 2050? We used the California Freight Forecasting and Travel Demand Model (CSF2TDM) to estimate how the measures explored in the previous section—mode share, VMT, delay, and emissions—may change by 2050. These forecasts are based on socioeconomic data provided by California MPOs, as well as current planned improvements to California's transportation system programmed in Caltrans' six modal plan, MPO's RTPs, the High-Speed Rail Business Plan, and the Climate Change Scoping Plan. Collectively, these changes are referred to as the 2050 Baseline (Figure 26), which is used in Chapter 4 to demonstrate how future transportation strategies may impact system performance. The tools and methods used to conduct this analysis are described in Chapter 4 and in the Technical Analysis Element.

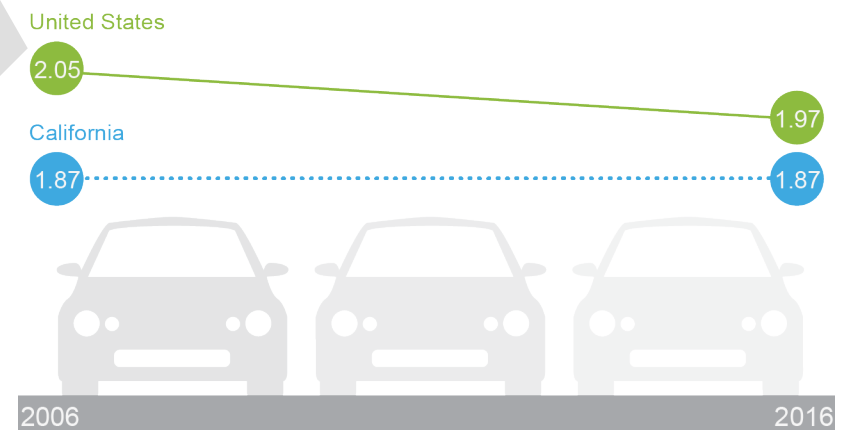
By 2050, Californians' mode choice and VMT per capita are not anticipated to change significantly, but the large number of new residents forecasted by California MPOs will significantly affect overall VMT and congestion. Lower

Auto Ownership

Whether or not an individual owns a car is one of the main factors that influence mode choice, and ultimately VMT. The average California household owns 1.87 vehicles—a trend that has not shifted since 2006. This is lower than the national average of 1.97, which has been trending downward from an all-time high of 2.05 in 2006. Changing travel needs and preferences, household income, and shared mobility and new technologies will all influence future auto ownership rates.

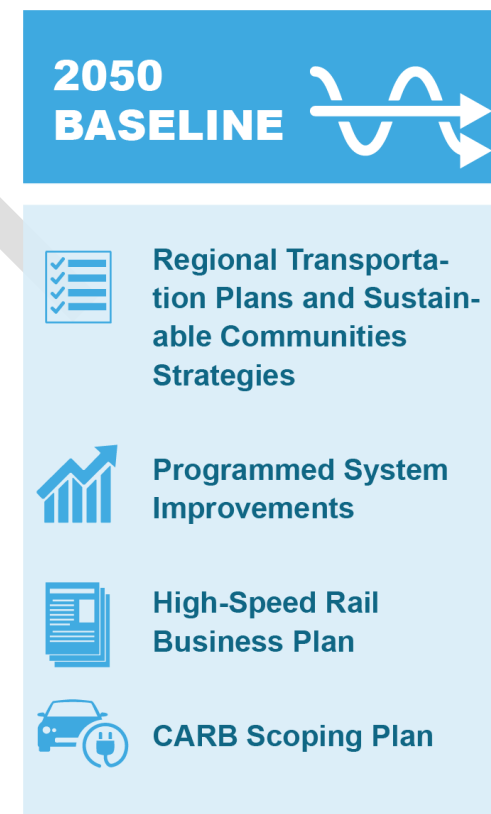
Source: Sivak, M. 2018. *Has Motorization in the U.S. Peaked? Part 10: Vehicle Ownership and Distance Driven, 1984 to 2016*. University of Michigan. <http://www.umich.edu/~umtristwt/PDF/SWT-2018-2.pdf>

FIGURE 25 AUTO OWNERSHIP PER HOUSEHOLD



Source: U.S. Census Bureau American Community Survey; 5-year estimates.

FIGURE 26 2050 BASELINE SCENARIO



population growth estimates forecasted by the DOF result in smaller increases in VMT and congestion. A comparison of these values is presented in Chapter 4. Meanwhile, despite the estimated increase in VMT, mobile source GHG emissions are expected to decline substantially by 2050 due to more widespread adoption of electric and fuel-efficient vehicle technologies.

Mode Share. In the 2050 Baseline, driving will remain the dominant mode of transportation by far. Non-auto mode share, primarily biking, walking, and transit, would rise (in total) by only one percentage point between 2015 and 2050—from 12 to 13 percent of total trips. Most of the shift would be due to people switching from driving to walking, with transit and biking experiencing minimal increases.

Vehicle Miles Traveled. VMT is expected to increase by 13 percent between 2015 and 2050 under DOF population forecasts, but could rise by as much as 35 percent if we experience the additional growth forecasted by California MPOs. Much of the growth will occur in California's most populous regions of the Bay Area and Los Angeles, with the San Joaquin Valley, Sacramento region, and Inland Empire also experiencing a significant increase due to high population growth estimates, and relatively fewer non-auto options. VMT per capita is expected to decline by an average of three percent statewide, except for the Northern California region and Sierras, where VMT per capita will increase by 10 percent and 13 percent, respectively, due to longer travel distances in those areas.⁹⁷

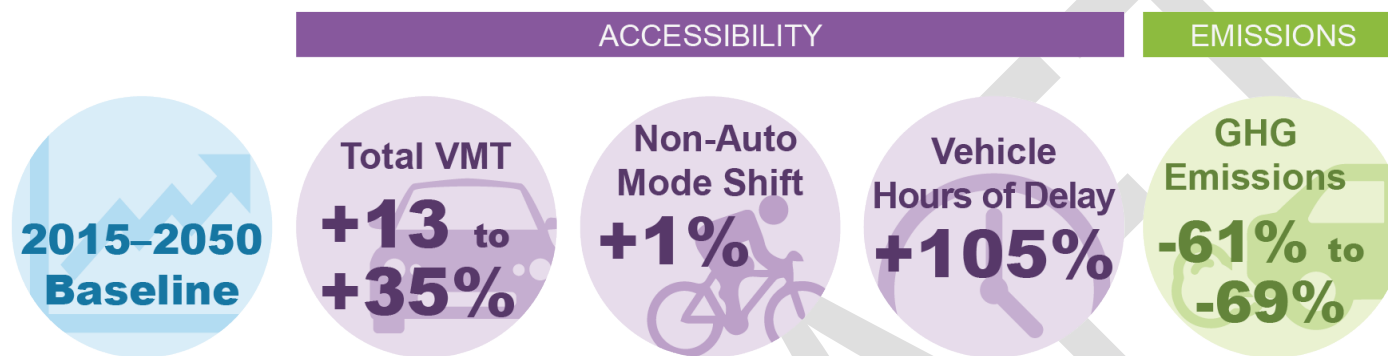
Delay. Without intervention, and assuming the growth forecasted by California MPOs, the amount of time Californians spend stuck in traffic could double by 2050. In 2015, the Los Angeles region accounted for more than half of statewide vehicle delay. However, forecasts show that by 2050, delay in Los Angeles will increase by only 46 percent, compared to the statewide average of a 105 percent increase.⁹⁸ The Central Coast and San Diego regions will also experience a less than 50 percent increase in delay, with Bay Area congestion expected to more than double.^v

Emissions. Despite rising VMT, GHG emissions could decline by 61 to 69 percent by 2050, depending on future population growth. The significant decline is due to advancements in clean vehicle technologies and fuel efficiency forecasted in the Climate Change Scoping Plan. In the past, GHG emissions and VMT have been closely correlated, with emissions rising as VMT increases. However, zero and low-emissions vehicles are changing this

^v These forecasts are from the CSF2TDM, and therefore may differ from regional forecasts included in RTPs.

relationship. This demonstrates that while ZEVs will help us reach our climate targets, we will still face accessibility challenges in 2050, such as growing congestion and delay, unless alternatives to personal auto travel become better options for more Californians.

FIGURE 27 OUR TRAVEL BY 2050 (2015 – 2050 BASELINE SHIFT)



Source: Accessibility measures are from CSF2TDM, emissions measures are from the Vision model.

How Travel May Be Changing

While the 2050 Baseline provides one snapshot of our transportation future based on what we know today, the many factors that influence travel are changing rapidly. People are living farther from work, yet broadband and internet connectivity are allowing people to work, shop, learn, and recreate from home—a trend that has accelerated following COVID-19. Vehicle electrification is already helping reduce transportation sector emissions, yet vehicle automation may make driving more appealing. Generational lifestyle differences, such as waning auto-ownership among youth populations, could change the modes we use to get around. Key trends that could have the greatest impact on our future travel preferences include:

- **Telework, telehealth, and distance learning.** Teleworking in the U.S. was on the rise even before coronavirus arrived—increasing seven percent between 2008 and 2015.⁹⁹ In March 2020, a recorded 34 percent of Americans were working from home. The abrupt increase in telework, distance learning, telehealth, and online shopping post-COVID-19 is expected to have a lasting impact as many companies, retailers, and restaurants shift to more permanent online operations. While the long-term transportation impacts of this trend are uncertain, it is clear that increasing virtual activity will affect where Californians choose to live, where they travel, how often they travel, and what modes they choose.

► **Data and information technology.** Mobile devices are becoming increasingly vital to everyday travel needs. These devices not help people get around, but collect massive amounts of data, which is transforming how transportation systems and services are planned and implemented. Data and information technology are enabling shared mobility platforms such as bike-share, car-share, and e-scooters, enabling integrated transit fare payment, and providing real-time traveler information, which are all transforming how Californians travel.

► **Connected and Autonomous Vehicles (CAV).** According to different studies, anywhere from 20 percent to 95 percent of miles traveled on U.S. roads could be in automated vehicles by 2030.¹⁰⁰ According to one report, fully automated taxi fleets could become a reality between 2023 and 2030.¹⁰¹ CAVs could offer important safety and network performance benefits, such as congestion relief, optimization of roadway capacity, less demand for parking, and improved safety by eliminating human errors in driving. However, if not properly regulated, they could also make auto travel more convenient, enabling people to live further from their destinations and adding to traffic congestion. The degree to which they are shared and electrified will determine the impact that CAV will have on VMT, accessibility, and other planning goals.

► **Goods movement.** E-commerce, 3D printing, same-day deliveries, automation, and electrification are drastically impacting freight transportation and land use. E-commerce is causing a shift to smaller, automated, warehouses staffed with fewer workers, while home deliveries are causing brick and mortar businesses to close, and city governments to reckon with how land use may need to be adjusted. 3D printing may allow people to obtain goods in their own homes, reducing the need to travel to retail centers. Autonomous trucks, warehouses, and the use of robots in production facilities are increasing the speed and efficiency of production, but sparking concerns about the loss of jobs.

► **Shared mobility.** Bike-share, car-share, and scooter-share, and transportation network companies (TNCs) have grown in popularity over the last decade. As of 2016, there were two million car-share members in Northern California alone, and 28 million bike-share users in the U.S.¹⁰² Shared mobility options have many benefits, including improved first-last mile connectivity to public transit, reduced need for urban parking, more efficient

How Might CAVs Impact Travel?

- Roadway capacities may increase as CAVs enable vehicles to platooning and to communicate with infrastructure and other vehicles.
- Parking may become less important in the decision to drive, increasing personal vehicle use.
- Limited mobility populations (children and older adults) may be more likely to travel by vehicle.
- Driving may become more desirable as people work, sleep, or engage in other non-driving activities during travel.
- Zero-occupant vehicle trips may increase as people are dropped off and send their vehicles home or elsewhere.

Source: Shaheen, S., Totte, H., & Stocker, A. (2018). Future of Mobility White Paper. UC Berkeley: Institute of Transportation Studies at UC Berkeley

use of roadway space, increased active transportation usage and public health outcomes, and more equitable and affordable travel for low-income communities. However, TNCs have also been shown to increase congestion and vehicle travel in many urban areas across the country.

- ▶ **Zero-emission vehicles.** Electric vehicle (EV) sales have been on the rise nationally, with California accounting for half the U.S. EV market. Studies indicate that by 2042, 37 percent of all vehicles could be electric.¹⁰³ California EO B-48-18 sets a target of 200 hydrogen fueling stations and 250,000 EV chargers to support 1.5 million ZEVs by 2025. Future EV adoption rates depend on whether personal vehicle ownership trends continue and if shared CAVs primarily use electric models. With more ZEVs on the road, we could see significant reductions in GHG emissions, yet traffic congestion may continue to rise.
- ▶ **Housing and land use.** The amount and location of new development will directly impact the magnitude and distribution of travel. To cope with the impacts of California's housing shortage, many cities have been incentivizing compact, mixed-use, infill development to increase housing density, especially in areas that are accessible to public transit and active modes. Denser land use offers an opportunity to accommodate travel demand with transit, shared mobility, biking, walking, and other low-carbon modes.

CASE STUDY: CALIFORNIA CONNECTED VEHICLE TESTBED

The nation's first public Connected Vehicle Test Bed, established in 2005, is in California on SR-82 (El Camino Real) in the Bay Area. In 2018, Caltrans and the PATH Program at UC Berkeley began upgrading the equipment to meet CV standards and expand the number of connected intersections. The corridor allows for testing of how connected vehicle technologies operate in real conditions. When the updates are complete, there will be 31 connected intersections across 7 miles of Silicon Valley. As these changes are completed, the corridor will be a model for urban connected vehicle corridors across California.

Source: <http://www.caconnectedvehicletestbed.org/index.php/>

IMPLICATIONS

The evidence presented in this chapter makes clear that maintaining our transportation status quo is not an option. While our mobility future will be shaped by the many external forces examined in this chapter, it will be shaped just as much by the plans, policies, strategies, and actions we implement along the way. The following chapter presents the guiding vision for our future transportation system, which is used to develop these recommendations.

3 OUR TRANSPORTATION VISION

POLICY ELEMENT

This chapter defines the vision for California’s future transportation system, which is made up of goals and objectives, and identifies performance measures to track progress toward achieving them. It serves as a guidepost to inform the selection of CTP recommendations. For more information on how this vision was developed, see the Plan Development Element.

Vision

“California’s safe, resilient, and universally accessible transportation system supports vibrant communities, advances racial and economic justice, and improves public and environmental health.”

By 2050, California’s transportation system will provide nearly 45 million residents with convenient and reliable access to jobs, education, health care, services, and more. It will offer a range of high-quality, safe, and affordable mobility options, connecting urban, rural, coastal, mountain, and inland regions into an integrated multimodal network. Urban centers such as Los Angeles, the San Francisco Bay Area, San Diego, and Sacramento, will build sufficient housing to meet demand. The majority of new housing will be built in transit-supportive areas and be affordable to low- and middle-income Californians, ensuring that residents have viable alternatives to the automobile, and that those who need to drive can do so amid minimal congestion. Rural and Tribal communities will enjoy greater access to jobs and goods through expanded mobility options and innovative technologies, while maintaining a rural way of life.

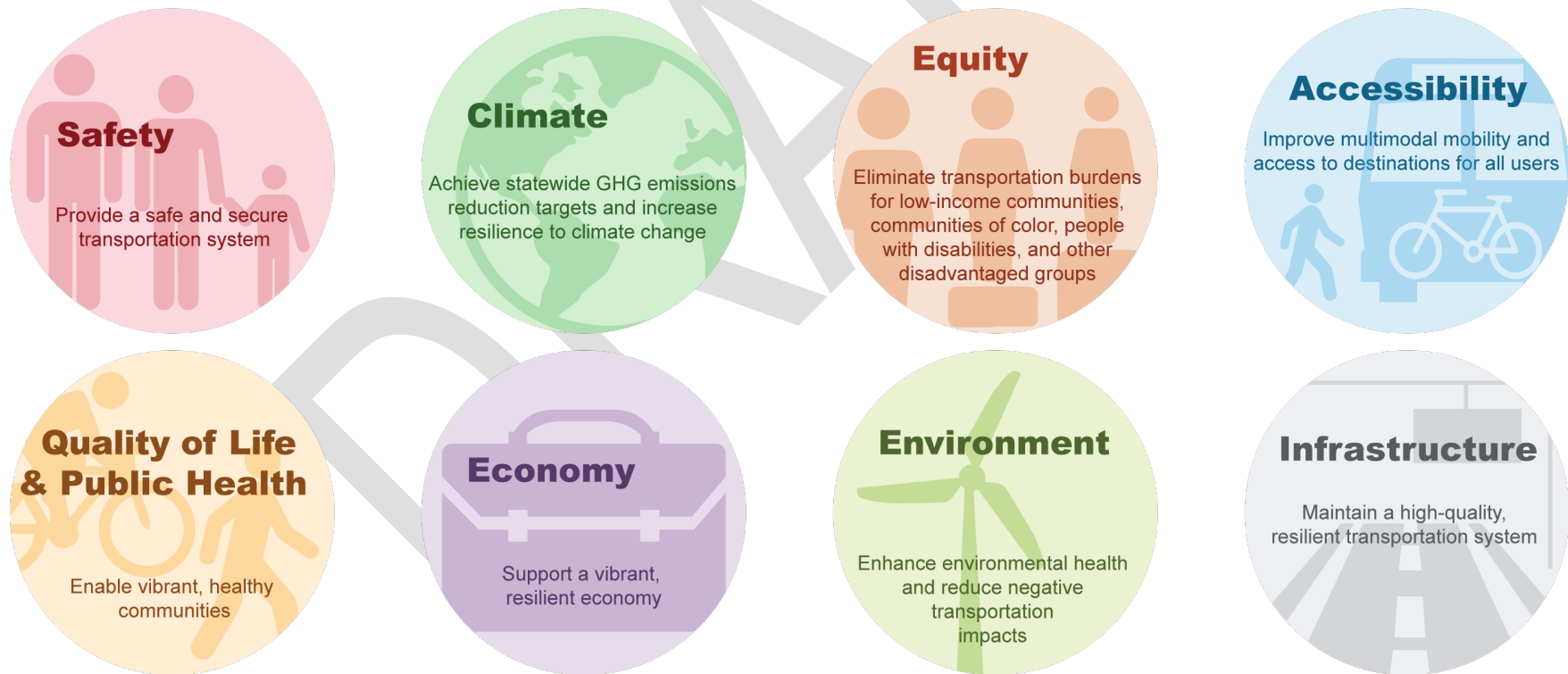
The 2050 transportation system will aim to reduce transportation-related fatalities and serious injuries to zero. It will be high-tech, high-quality, and resilient to the impacts of climate change, earthquakes, pandemics, and other disruptions, ensuring protection of our invaluable natural and cultural resources. It will power the expansion and diversification of California’s world-class economy, with a modernized and sustainable freight system that supports local economic growth. Our future transportation system will be carbon-neutral, enhancing public health and quality of life for all Californians,

regardless of race, ethnicity, income, age, gender, sexual orientation, or ability. Our future system will advance quality of life and economic opportunity for people of color and low-income communities, who have long endured the greatest burdens of our transportation system, building economic opportunity and mobility for those who need it most.

GOALS AND OBJECTIVES

How can we make this vision a reality? We asked hundreds of stakeholders across the state to identify their priority goal areas for the CTP 2050. Their input was reviewed and refined by the CTP 2050 PAC, as well as teams of subject matter experts, resulting in eight interrelated transportation priorities for the state, each of which is supported by more specific objectives. These goals and objectives informed the analytic process underlying the CTP 2050 and the identification of plan recommendations described in Chapter 5. This section introduces each goal, its objectives, and performance measures that can be used to monitor progress toward achieving it in the years ahead. An asterisk (*) indicates performance measures that are required by federal law.

FIGURE 28 CTP 2050 GOALS





SAFETY: Provide a safe and secure transportation system

Moving people to and from destinations safely and securely is California's top transportation priority. In 2015, California committed to eliminating fatalities on the transportation system through the "Toward Zero Deaths" campaign. While eliminating all transportation deaths is an ambitious goal, it is the only acceptable one. The CTP 2050 aims to expand upon current statewide safety efforts and demonstrate additional commitment to providing a safe and secure transportation system for all users.

Objectives:

1. Eliminate fatalities and serious injuries on the transportation system

In 2018, more than 3,600 people were killed on California's roads, making up 10 percent of the nation's traffic fatalities.¹⁰⁴ Fatality rates among bicyclists and pedestrians are disproportionately high, representing 16 percent of all traffic fatalities and only a small share of total collisions.¹⁰⁵ In addition, there were 488 motorcycle fatalities for 2018.¹⁰⁶ This objective seeks to eliminate fatalities and serious injuries across all modes.

2. Improve personal security and infrastructure security on the transportation system

The emergence of advanced transportation technologies has broadened security concerns, including personal security while traveling on the transportation system, data security, cybersecurity, and the security of infrastructure itself. This objective aims to address these growing security risks proactively to ensure that

emerging technologies support safety and security on the transportation system.

3. Improve emergency preparedness, response, and recovery on the transportation system

California's transportation system faces risks from natural disasters, pandemics, earthquakes, sea level rise, and severe weather events such as flooding, extreme temperatures, wildfires, and mudslides. This objective involves preparing for and responding to these incidents as they become frequent and severe.

Performance Measures:

- ▶ Number of fatalities*
- ▶ Rate of fatalities per 100 million VMT*
- ▶ Number of serious injuries*
- ▶ Number of serious injuries per 100 million VMT*
- ▶ Number of non-motorized fatalities and non-motorized serious injuries*



CLIMATE: Achieve statewide GHG emission reduction targets and increase resilience to climate change

California is a global leader in climate policy. SB 391 requires the state to achieve an 80-percent reduction below 1990 levels in GHG by 2050, EO-B-55-18 calls for carbon-neutrality by 2045, SB 100 requires 100 percent clean energy by 2045, and EO-N-19-19 requires California to redouble efforts to reduce GHG emissions. Yet current trends indicate that we are not on track to meet these targets in 2050.¹⁰⁷ The CTP 2050 must take bold action to ensure that we go beyond existing plans,

policies, and program to meet these ambitious goals. We must also ensure that our communities are resilient to the impacts of climate change and have the resources to adapt to and mitigate future risks.

Objectives:

1. Advance a clean, carbon neutral transportation system

This objective aims to meet GHG reduction targets, move the transportation sector away from dependence on carbon-based fuels, and position California to achieve full carbon neutrality over the plan horizon.

2. Increase climate resiliency

This objective seeks to ensure that our transportation system is resilient to the growing impacts of climate change, by identifying infrastructure vulnerabilities and adapting our system to address them.

Performance Measures:

- ▶ Transportation sector GHG emissions
- ▶ Carbon capture and sequestration
- ▶ Number of system improvements addressing climate vulnerability



EQUITY: Eliminate transportation burdens for low-income communities, communities of color, people with disabilities, and other disadvantaged groups

As discussed in Chapter 1, there are significant disparities in how people of color have been impacted by transportation decisions, and

how those decisions have impacted access to housing, education, health care, and other services. The CTP 2050 aims to advance social equity by actively directing support, resources, and protections to disadvantaged communities, and ensuring that the highest quality transportation options are available to those who need them most.

Objectives:

1. Improve transportation-related economic, environmental, and public health outcomes for disadvantaged communities

This objective aims to reverse the harmful transportation practices of the past, and to achieve a future in which current and historically disadvantaged communities have access to clean air and water, and all families and individuals can afford to choose where they live and how they travel, regardless of race, ethnicity, class, gender, or ability.

2. Improve access to a range of high-quality, safe, and affordable mobility options within disadvantaged communities

With rising transportation and housing costs becoming increasingly burdensome for low and middle-income households, this objective addresses the critical need to provide equal and affordable mobility options within disadvantaged communities.

3. Support disadvantaged communities in playing an active and direct role in transportation decision making

The disparities that disadvantaged communities experience today are due in part to exclusion from transportation planning, engagement, and decision-making processes. This objective addresses the need to partner and collaborate with disadvantaged communities, ensuring historically excluded voices are centered in the transportation decision-making process.

Performance Measures:

- ▶ Access to destinations by income quintile and race
- ▶ Transportation and housing cost burden by income quintile and race



ACCESSIBILITY: Improve multimodal mobility and access to destinations for all users

Accessibility (the ease by which people and goods can reach destinations) is a function of both *mobility* (the movement of people and goods) and *proximity* (the distance between origins and destinations). Accessibility improves when destinations are closer, when transportation systems perform well, and when people have access to a range of safe, connected, and reliable travel options. Traditionally, transportation plans have focused on mobility alone. This goal goes beyond mobility to encourage both land use and transportation solutions that improve people's access to jobs, services, educational opportunities, recreation, and more.

Objectives:

1. Increase access to destinations

Accessibility can be improved not only through transportation system enhancements, but through compact, diverse land uses that support multiple modes and facilitate shorter and more convenient trips.

2. Increase the competitiveness of transit, shared mobility, and active transportation options

This objective recognizes the need to address the current auto-oriented nature of our transportation system by leveling the playing

field across modes. It requires expanding access to airports, transit, first- and last-mile options, biking and walking, and emerging forms of on-demand, shared and dockless mobility, in a way that is safe, affordable, and accessible to people of all ages, incomes, and abilities.

3. Provide integrated and seamless travel connections

Many Californians use multiple modes of transportation to reach their destinations. Integrating and connecting these modes, as well as addressing gaps in the existing transportation network, is essential to improving the convenience and reliability of travel throughout the state.

4. Optimize system performance for all modes

To maximize accessibility for future generations, California must address our growing traffic congestion and optimize system performance across all modes of travel.

Performance Measures:

- ▶ Percent of travel by non-single occupancy vehicles*
- ▶ Percent of person-miles traveled on the Interstate Highway System that are reliable*
- ▶ Percent of person-miles traveled on the non-Interstate NHS that are reliable*
- ▶ Annual hours of peak-hour excessive delay per capita*
- ▶ Access to destinations by mode
- ▶ Access to destinations by travel cost
- ▶ Households with access to transit service
- ▶ Average on-time performance for transit and intercity rail



QUALITY OF LIFE & PUBLIC HEALTH: Enable vibrant, healthy communities

Quality of life refers to the health, comfort, and happiness experienced by individuals and communities. Supporting a high quality of life means offering modal choices that meet the diverse needs of California communities, whether that means advancing dockless mobility in dense urban areas, expanding electric vehicle use and on-demand options in rural areas, or supporting shared CAVs in suburban communities. This goal also aims to protect public health by ensuring that transportation systems support physical distancing, sanitation, and other measures that prevent the spread of COVID-19 and other illnesses.

Objectives:

1. Expand access to healthy transportation options

This objective seeks to reduce dependence on the single-occupant vehicle and ensure that people have access to safe and healthy travel options such as biking, walking, and transit.

2. Reduce household transportation costs

In recent decades, a high cost of living has forced many Californians to live further from jobs, services, and amenities. This has increased the cost of travel, roadway congestion, and time spent traveling by car, which can exacerbate both physical and mental health problems. Household transportation costs can be reduced when accessibility, mobility options, and proximity to destinations are improved.

3. Improve transportation-related public health outcomes

Transportation and public health are directly linked. This objective aims to improve public health outcomes, such as reducing exposure to air pollution, minimizing safety risks, and providing access to healthy travel options. As the COVID-19 pandemic has shown, this also means making sure that transit and shared modes can be accessed with minimal risk of infectious disease transmission.

4. Support enjoyable trip experiences and vibrant public spaces

Transportation is not just used to get from point A to point B. It can be used for recreation, art, public events, and more—all of which contribute to the activated public spaces that make California communities so unique and inviting. This objective aims support public spaces that are vibrant, inviting, and inclusive.

Performance Measures:

- ▶ Percent of household income spent on housing and transportation costs
- ▶ Vehicle miles traveled per capita
- ▶ Active transportation mode share



ENVIRONMENT: Enhance environmental health and reduce negative transportation impacts

California is ecologically diverse and rich in natural and cultural heritage. Reducing the impacts of transportation on ecosystems and communities has been a California priority for half a century. As our population continues to grow, we must support biodiversity and ecosystem health both for its intrinsic value and for its role in supporting our resource and

recreational needs. This goal aims to minimize the adverse environmental impacts of the transportation system, while enhancing California's natural and cultural resources.

Objectives:

1. Improve air quality and minimize pollutants from transportation

Transportation is the largest contributor to statewide GHG emissions. Criteria air pollutants such as particulate matter, carbon monoxide, nitrogen oxide, and volatile organic compounds have been linked to a wide range of public health issues. This objective aims to reduce pollutants and improve health outcomes.

2. Protect and enhance California's natural resources and ecosystems

Through thoughtful planning and design, California's multimodal transportation system can incorporate materials, technologies, and design features that protect and enhance natural resources and ecosystems.

3. Protect and enhance California historic and cultural resource

California's historic and cultural resources represent the state's rich history and diverse population and must be protected and enhanced through careful planning and design.

Performance Measures:

- ▶ Total emissions reduction for NOx, VOCs, CO, PM10 & PM2.5
- ▶ Acres of protected open space
- ▶ Acres converted from natural habitat and agricultural to urban use
- ▶ Number of fish passages mediated



ECONOMY: Support a vibrant, resilient economy

To remain competitive in an increasingly globalized and ever-changing economy, California must maintain a vibrant multimodal transportation system with world class ports, airports, railways, highways, streets, and transit systems. Yet sustaining economic growth requires more than just infrastructure. The economy, and the transportation system that supports it, must be diverse, equitable, and sustainable. This requires a system that is well-maintained; sensitive to the natural environment; and resilient to increasing threats from severe weather events, natural disasters, and pandemics; while ensuring that Californians of all income levels, regions, and backgrounds have high-quality transportation choices and access to opportunity.

Objectives:

1. Support diverse, equitable, and sustained economic growth

California's transportation system is foundational to economic activity, providing households with access to jobs, education, and services, while connecting California businesses and consumers to the world marketplace. Our transportation system must support sustained economic growth and prosperity for all Californians.

2. Facilitate efficient, reliable, and sustainable goods movement

California residents and businesses rely on the freight system to access goods, get shipments delivered, and to access the global marketplace. Efficient, reliable, and sustainable ports, intermodal facilities, railways, truck routes, and air traffic, are integral to the growth and success of California's world class economy.

3. Support local and regional economic development

Local and regional economies provide jobs, income, and services that are foundational to a high quality of life. This objective is aimed at expanding transportation investments that attract and retain California businesses, workforce, and other elements needed to support local and regional economic development.

Performance Measures:

- ▶ Truck Travel Time Reliability (TTTR) Index*
- ▶ Annual twenty-foot equivalent units (TEUs) imported & exported through California ports
- ▶ Annual Employment Growth



INFRASTRUCTURE: Maintain a high-quality, resilient transportation system

Maintaining the performance and condition of California's transportation system is vital to our economy and the daily lives of millions of Californians. As our population grows to nearly 45 million by 2050, providing high-quality infrastructure also means adapting assets to accommodate changing demand, and leveling the playing field for active transportation, rail, transit, and shared modes. Our infrastructure must also be resilient to the impacts of earthquakes, extreme temperatures, fires, sea level rise, and pandemics. Supporting these goals requires more efficient and effective project delivery, and sustainable long-term funding sources. The CTP 2050 aims to secure more long-term, dedicated funding to help achieve our transportation vision.

Objectives:

1. Preserve and maintain existing multimodal transportation assets in a state of good repair

California must maintain its system in a state of good repair by understanding the life cycle of system assets, historical usage, and anticipating future usage. This includes adapting assets to accommodate changing demands and preferences, after decades of prioritizing auto-oriented infrastructure.

2. Increase infrastructure resiliency to climate change and natural disasters

Adapting to risks posed by climate change and natural disasters requires understanding our transportation system's exposure and sensitivity to these threats, determining likely consequences, and prioritizing investments to address and mitigate risks.

3. Improve efficiency in project delivery

Accelerating project completion through eliminating delays in the transportation project development and delivery process will enable the most efficient use of limited time and resources

4. Secure sustainable, dedicated, long-term funding for the transportation system

Achieving the bold vision of CTP 2050 will require ample sustainable, dedicated, and long-term sources of transportation system funding at the state and local levels.

Performance Measures:

- ▶ Percentage of interstate pavements in good condition*
- ▶ Percentage of interstate pavements in poor condition*

- ▶ Percentage of non-interstate NHS pavements in good condition*
- ▶ Percentage of non-interstate NHS pavements in poor condition*
- ▶ Percentage of bridges in good condition*
- ▶ Percentage of bridges in poor condition*
- ▶ Airport pavement in good condition
- ▶ Lane-miles of pavement improved
- ▶ Bridges rehabilitated
- ▶ Culverts rehabilitated
- ▶ Transportation management system (TMS) asset condition
- ▶ Lane-miles repurposed
- ▶ Transit asset condition
- ▶ Utilize Highway Capacity Manual bicycle level of service (BLOS) and level of traffic stress (LTS), for evaluation of bicycle safety.

REALIZING THE VISION

This chapter presented the transportation-related outcomes sought by California communities, as informed by lengthy engagement and outreach across sectors and regions of the state. But what steps can we take in the years ahead to achieve these goals? The following chapter introduces the process used to gather and evaluate candidate strategies that could help bring our transportation vision to reality.

4 MAKING PROGRESS

This chapter explores strategies to help achieve our vision, and the benefits they could bring to California's transportation system. It describes the process for developing scenarios, the results of scenario analysis, and the implication of these results for policy decision-making.

To achieve the CTP 2050 vision, we identified a range of strategies and explored how each might address the goals and objectives identified in the previous chapter. A lengthy research and engagement effort conducted in 2019 yielded more than 300 potential strategies to support the CTP 2050 vision, goals, and objectives. Recognizing that California cities, transit agencies, MPOs, RTPAs, and other entities are already exploring innovative and groundbreaking transportation strategies, many of the CTP 2050 strategies are rooted in and build upon these efforts. These strategies were gathered through a comprehensive review of Caltrans' six modal plans, California RTP/SCS's, other recent statewide and regional plans and programs, research and international best practice, and stakeholder recommendations. Figure 29 highlights some of the major transportation strategies being pursued around the globe to improve mobility and reduce transportation emissions, while Figure 30 shows the total number of strategies that were identified under each CTP 2050 goal area. For the full list of identified strategies, see the Strategies Element.

FIGURE 29 GLOBAL TRANSPORTATION STRATEGIES

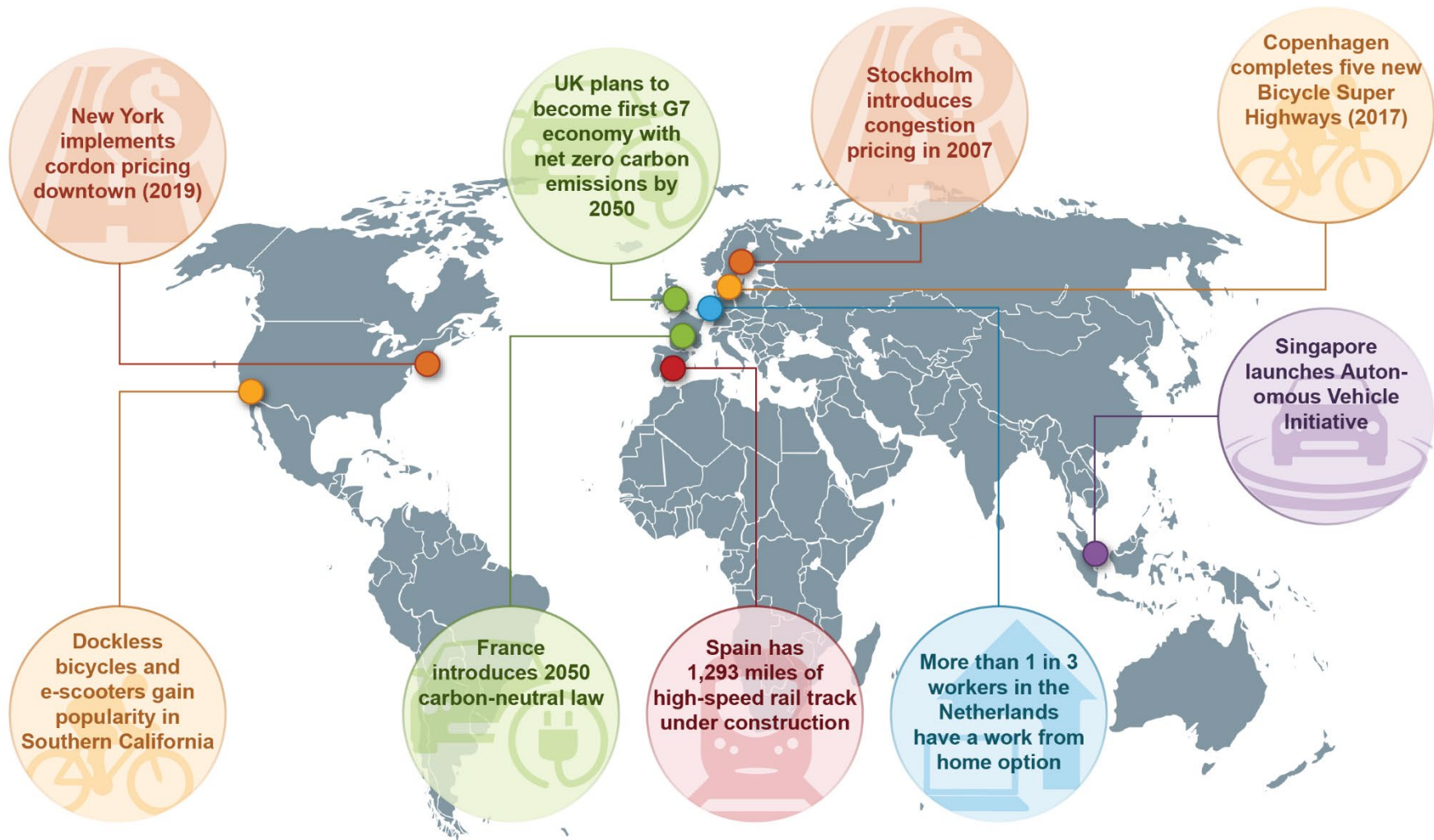
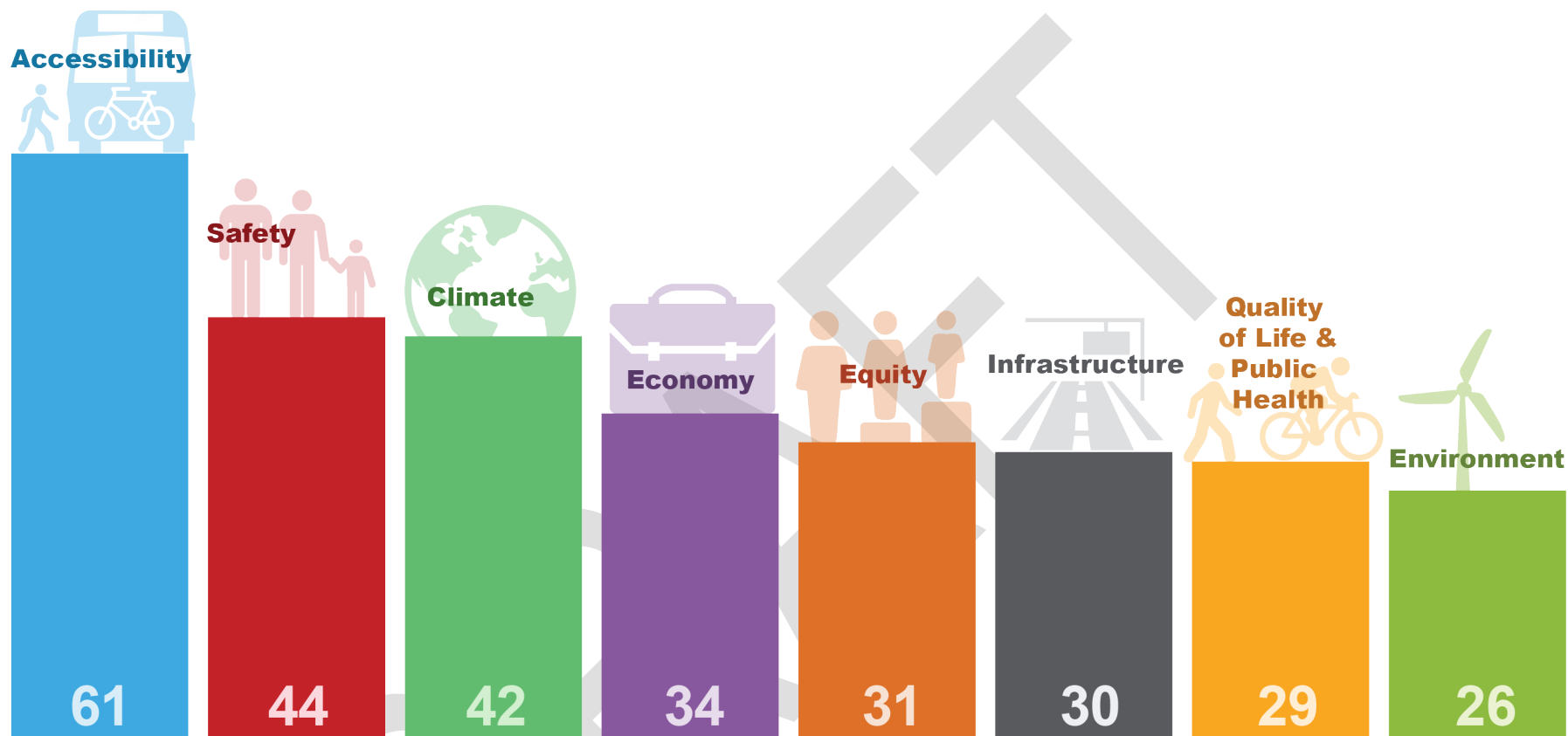


FIGURE 30 STRATEGIES CONSIDERED IN THE CTP 2050



MODELING TOOLS

Three exploratory modeling tools were used to evaluate future conditions and assess the degree to which various transportation and land use strategies can help California reach its 2050 GHG emission reduction targets, and other statewide goals. Each of these tools informed the selection of plan recommendations by providing insight on the magnitude of impact of various strategies and identifying any potential benefits and drawbacks. For more detail on the modeling and analytic process, see the Technical Analysis Element.

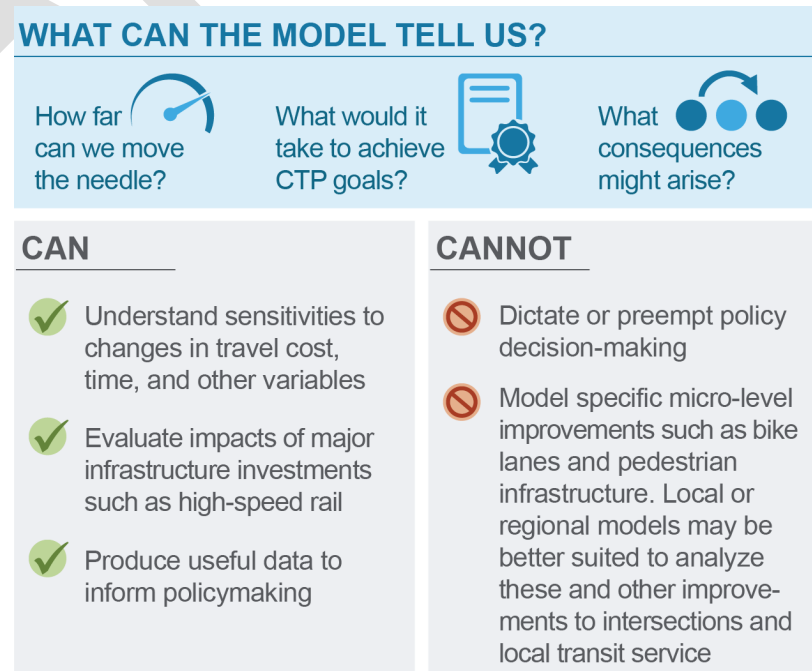
- ▶ **Travel Demand Modeling:** The California Statewide Freight Forecasting and Travel Demand Model (CSF2TDM) forecasts all personal and freight travel throughout the state based on changes in population and employment growth, development patterns, travel behavior, and transportation infrastructure investments. The CSF2TDM can tell us how each individual strategies and groups of strategies (scenarios) will impact VMT, mode share, trip length, vehicle hours of delay, and vehicle hours traveled. These measures are key to evaluating plan benefits and achieving our climate targets and other CTP goals of accessibility, public health, and quality of life.
- ▶ **Emissions Modeling:** Using the CSF2TDM outputs described above, the Vision model was used to estimate future GHG emissions. Vision incorporates assumptions about future electric vehicle usage, fleet mix (cars vs. trucks), and fuel efficiency.ⁱ It also accounts for “well-to-wheel” emissions, which include the production and distribution of fuel and vehicles to provide a complete inventory of transportation emissions. It is critical to understanding which of the CTP 2050 strategies and scenarios can help California meet its GHG emissions reduction goals, and to identify any further fleet mix and fuel efficiency gains that may be needed to close the gap.
- ▶ **Economic Modeling:** The Transportation Economic Development Impact System (TREDIS) model evaluates statewide economic impacts associated with future growth and transportation improvements. As discussed in Chapter 2, transportation investments stimulate the economy by creating jobs, helping people access jobs, and allowing for more efficient movement of goods. TREDIS uses CSF2TDM outputs to explore how changes in VMT, mode split, and other travel behaviors could impact jobs, income, and gross state product at the state and regional level. These economic measures are key to understanding our ability to reach our economic goals, as well as other CTP goals of equity and quality of life.

EVALUATING STRATEGIES

Out of the hundreds of strategies identified to further the CTP 2050 vision, only a handful can be evaluated quantitatively. These strategies were combined in various ways to form three scenarios described in the following section. These scenarios were modeled using the analytic tools described above. This section describes each strategy that was modeled as part of the scenario analysis.

Models are essential tools to inform policy-making, but they have notable limitations, and are far too blunt a tool to guide policy without intervention. **The specific strategies and levels of implementation explored in the modeling process below should not be misconstrued as dictating or preempting the**

FIGURE 31 THE PURPOSE OF MODELING



plan recommendations presented in Chapter 5. Rather, the modeling decisions made below presented to decision-makers with critical information regarding the magnitude of system changes necessary to meet 20250 GHG reduction targets and other goals, and the consequences and tradeoffs that may arise.

While the model can account for major capacity enhancements such as adding new freeways or lanes, research has proven that these capacity expansions can lead to more traffic, a phenomenon called “induced demand,” in which roadway expansions lead to more vehicle travel. The CTP did not explore new major roadway expansions because such enhancements conflict with state goals of reducing VMT. In addition, despite the many benefits associated with bicycle and pedestrian infrastructure investments, these improvements cannot be directly evaluated because the model does not contain bicycle and pedestrian networks. However, changes to land use, transit, pricing, and other factors can cause people to shift to active modes—and these shifts are reflected in the modeling results. Figures 32 and 33 present the major strategies analyzed by the CSF2TDM.

FIGURE 32 MODELED STRATEGY ASSUMPTIONS (STRATEGIES 1–4)

STRATEGY	HOV LANES 	LOCAL TRANSIT 	MOBILITY AS A SERVICE 	ALTERNATIVE FREIGHT DELIVERIES 
DESCRIPTION	<p>High Occupancy Vehicle (HOV) lanes offer more efficient use of existing capacity. Transit buses, motorcycles, clean vehicles, and vehicles with multiple occupants can use these lanes to bypass congested general-purpose lanes.</p> <p>There are more than 1,765 HOV lane miles in California, most of which are available to vehicles with at least 2 passengers.</p>	<p>Local transit systems such as buses, light rail, ferries, and vanpools provide people with an alternative to driving—resulting in fewer cars on the road and better access to jobs and services. In 2015, 4% of California travel was by local transit. California stakeholders felt that a bold transit policy that not only expands service capacity and frequency, but makes fares free, should be explored in the CTP 2050.</p>	<p>Mobility as a Service (MaaS), which includes bike-share, car-share, scooter-share, and dockless mobility options have been growing in popularity over the last decade. MaaS supports more efficient use of our infrastructure by encouraging carpooling, shared rides, active travel, and therefore less dependence on personal vehicles.</p>	<p>Our freight system carries more than 2.5 billions of tons of goods per year, proving critical to our economy and quality of life. However, it also contributes to statewide VMT and GHG emissions—both of which the CTP aims to reduce. These impacts are growing as e-commerce and deliveries become increasingly common. The CTP 2050 explores the impact of shifting to more sustainable forms of last-mile delivery, such as bike couriers, drone deliveries, and pick-up locations.</p>
MODELED	Require 3 or more occupants in all exiting HOV lanes	Double local transit capacity, service frequency, and eliminate fares	Increase in MaaS and pooled-ride services	50% reduction in truck last-mile deliveries

FIGURE 33 MODELED STRATEGY ASSUMPTIONS (STRATEGIES 5–7)




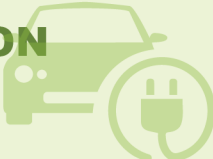

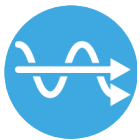
STRATEGY			
	ROADWAY PRICING	INTERCITY RAIL	CONNECTED & AUTONOMOUS VEHICLES
DESCRIPTION	<p>Roadway pricing is gaining global momentum as a way to address traffic congestion and use infrastructure more efficiently. Managing congestion through means-based pricing not only supports CTP goals of reducing VMT and GHG emissions, but improves accessibility and travel conditions for those who rely on cars to get around. There are many forms of pricing that can be used to incentivize behavior change:</p> <p>Congestion pricing—a charge for using busy roadways that rises during periods of high congestion.</p> <p>Cordon pricing—a fee for vehicles that cross a certain geographic threshold, such as a city boundary or central business district.</p> <p>Parking pricing—a fee for parking, particularly in high-demand city centers.</p> <p>Tolls—a fee for the use of specific roadways or bridges.</p>	<p>Commuter and intercity rail are proven to reduce VMT and GHG emissions by providing a non-auto, non-air travel option for long-distance trips. Investments such as high-speed rail are also shown to boost local economic activity by creating jobs, attracting business, and generating revenue—which is particularly beneficial in the rapidly growing Central Valley, where many people struggle economically and where transportation investments have not rivaled that of more populated coastal areas. In addition to the planned high-speed rail from Anaheim to San Francisco, the CTP 2050 explores the impact of the full 2018 State Rail Plan Vision, which includes expanding high-speed rail to Sacramento, the Inland Empire, and San Diego, building new regional rail system connections, improving rail speed and service frequency, and building dedicated freight rail capacity.</p>	<p>By 2030, anywhere from 20–95% of all travel could be in connected and autonomous vehicles (CAV). Clearly, the volume and impacts of CAVs are still highly uncertain. Left unchecked, they could lead to more VMT, zero-occupant travel, urban sprawl, and unsafe interactions with roadway users outside the automated environment. With strong regulation, CAVs could lead to more shared rides, reduced emissions, improved network efficiency, and enhanced safety for all users. The CTP 2050 evaluated the benefits of CAV if they are regulated to achieve the aforementioned benefits.</p>
	<p>50% increase in auto-operating costs in urban counties of MTC, SCAG, SANDAG, and SACOG, not including the lowest income quintile; cordon pricing of \$10 in LA, SF, SJ, OAK, SAC, SD.</p>	<p>2018 State Rail Plan Vision</p>	<p>Future CAVs are shared, efficient, and electric</p>

FIGURE 34 MODELED STRATEGY ASSUMPTIONS (STRATEGIES 8–10)

STRATEGY	TELEWORK 	ZERO-EMISSION VEHICLES 	LAND USE 
DESCRIPTION	<p>Telework is a critical strategy for VMT and GHG emissions reduction. When people work from home, there are fewer cars on the road, leading to reduced congestion, delay, and emissions. In 2015, about 5% of Californians worked from home, which increased to 34% at the onset of COVID-19. The CTP 2050 explores the impacts to VMT and GHG emissions reduction if half of Californians were to work from home in 2050.</p>	<p>Zero-emission vehicles (ZEV) and clean fuel technologies hold tremendous potential for reaching 2050 GHG emissions reduction targets. California has a breadth of existing plans that address ZEVs and clean fuel technologies, including the ZEV Action Plan, Vehicle-Grid Integration (VGI) roadmap, Sustainable Freight Action Plan, and the 2017 Climate Change Scoping Plan, which includes assumptions about future fuel efficiency and ZEV fleet mix. These were used to estimate 2050 GHG emissions reduction. See the Technical Analysis Element for more detail.</p>	<p>While largely outside the direct control of state agencies, land use plays a critical role in achieving our transportation goals. The CTP 2050 explored the transportation impacts of more dense future land use, which would reduce the distance Californians need to travel to reach jobs, goods, and services, and allow people to use a wider range of transportation options. For details on the methodology and assumptions about future land use, see the Technical Analysis Element.</p>
MODELED	<p>Half of Californians work from home</p>	<p>2017 Climate Change Scoping Plan</p>	<p>Future growth in population and employment occurs in California's most dense areas</p>

EXPLORING FUTURE SCENARIOS

The strategies described in the previous section were combined in various ways to form three distinct scenarios (Figure 35). **A scenario, as referenced in this document, is defined as a package of one or more transportation and/or land use improvements.** The CTP 2050 scenarios were developed based on extensive committee input and guidance, research, and best practices. Given California's growing housing shortage and its transportation implications, stakeholders felt the CTP 2050 should explore the degree to which significant changes in land use might impact transportation outcomes. The "Land Use Focus" Scenario, described below, is intended to show the extent to which land use alone can reduce VMT, GHG emissions, mode shift, and other measures. Similarly, a "Transportation Focus" scenario was crafted to show how solutions such as rail, pricing, and new technologies might cumulatively impact these same measures, irrespective of land use. A final "Combined" Scenario was developed to evaluate the impacts of integrating land use and transportation investments. Telework was added as a strategy in the Combined Scenario after the onset of COVID-19 due to its observed impact on VMT reduction. The following section summarizes the findings of the scenario analysis, providing a comparison between scenarios and the 2050 Baseline scenario described in Chapter 2. The scenarios explored include:



2050 Baseline— examines what could happen by 2050 if current trends continue, and if regionally adopted plans are implemented. The Baseline scenario includes all planned and programmed improvements in statewide and regional plans, such as RTP/SCSs, Caltrans' Modal Plans, the High-Speed Rail Business Plan, and the Climate Change Scoping Plan. All of the improvements included in the 2050 Baseline scenario are also reflected in the three CTP 2050 scenarios.



Transportation Focus—examines a future in which we focus our efforts solely on transportation-related strategies such as rail and transit investments, roadway pricing, and regulating emerging technologies such as CAVs. These improvements are intended to incentivize a shift toward transit, rail, walk, and bike modes through providing better transportation options. This scenario would lead to significant revenue generation as a result of pricing, which would be reinvested into non-auto modes to spur the shift.

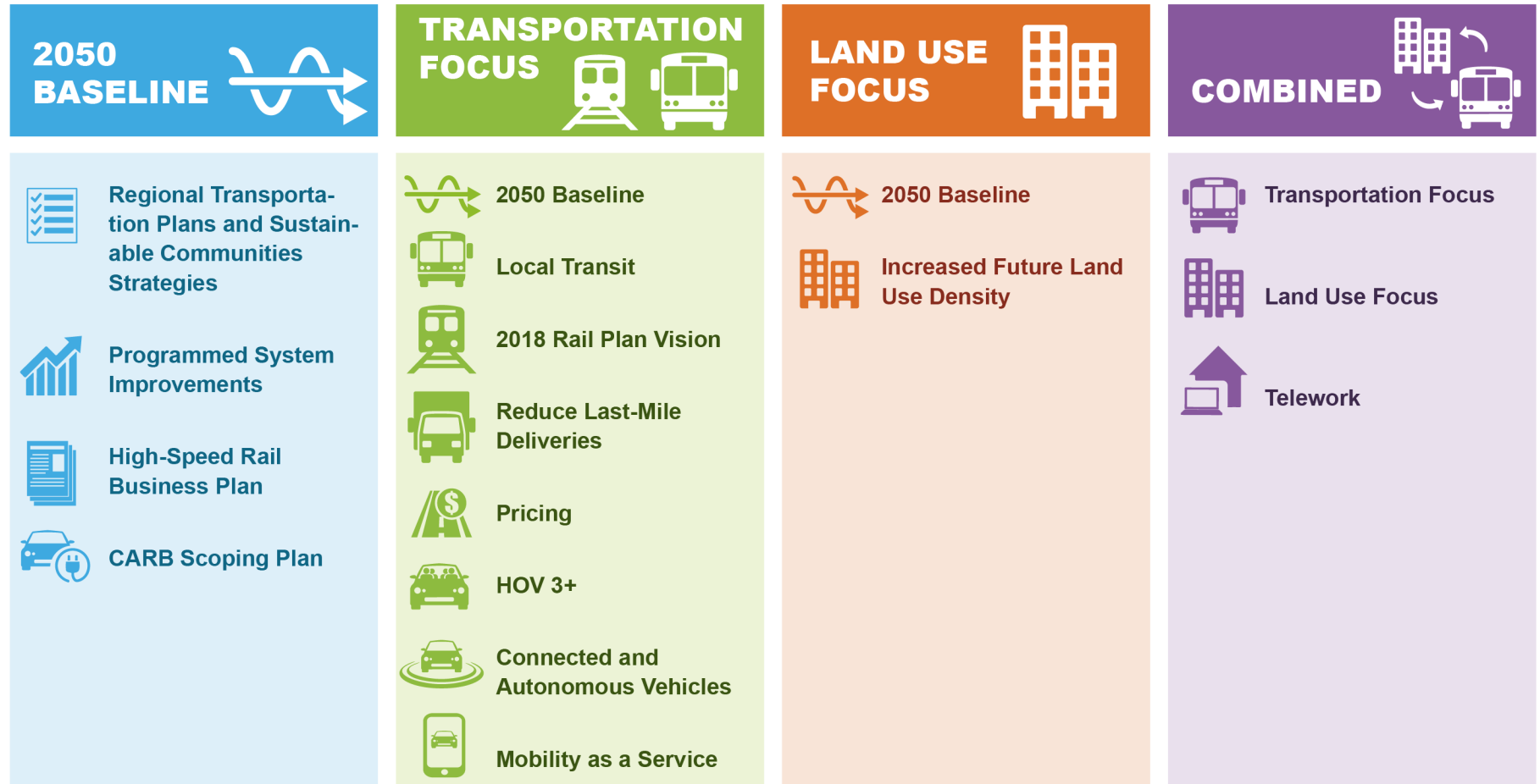


Land Use Focus— examines a future in which housing and land development policies implemented over the next three decades encourage greater density in urban areas, leading to concentrated population and employment growth. This scenario explores the impacts of reducing travel distances between destinations to see how far land use alone can get us to reaching our goals.



Combined—explores the impacts of implementing the strategies in both the transportation and land use focus scenarios, as well as expanded telework for jobs that can accommodate it.

FIGURE 35 CTP 2050 SCENARIOS



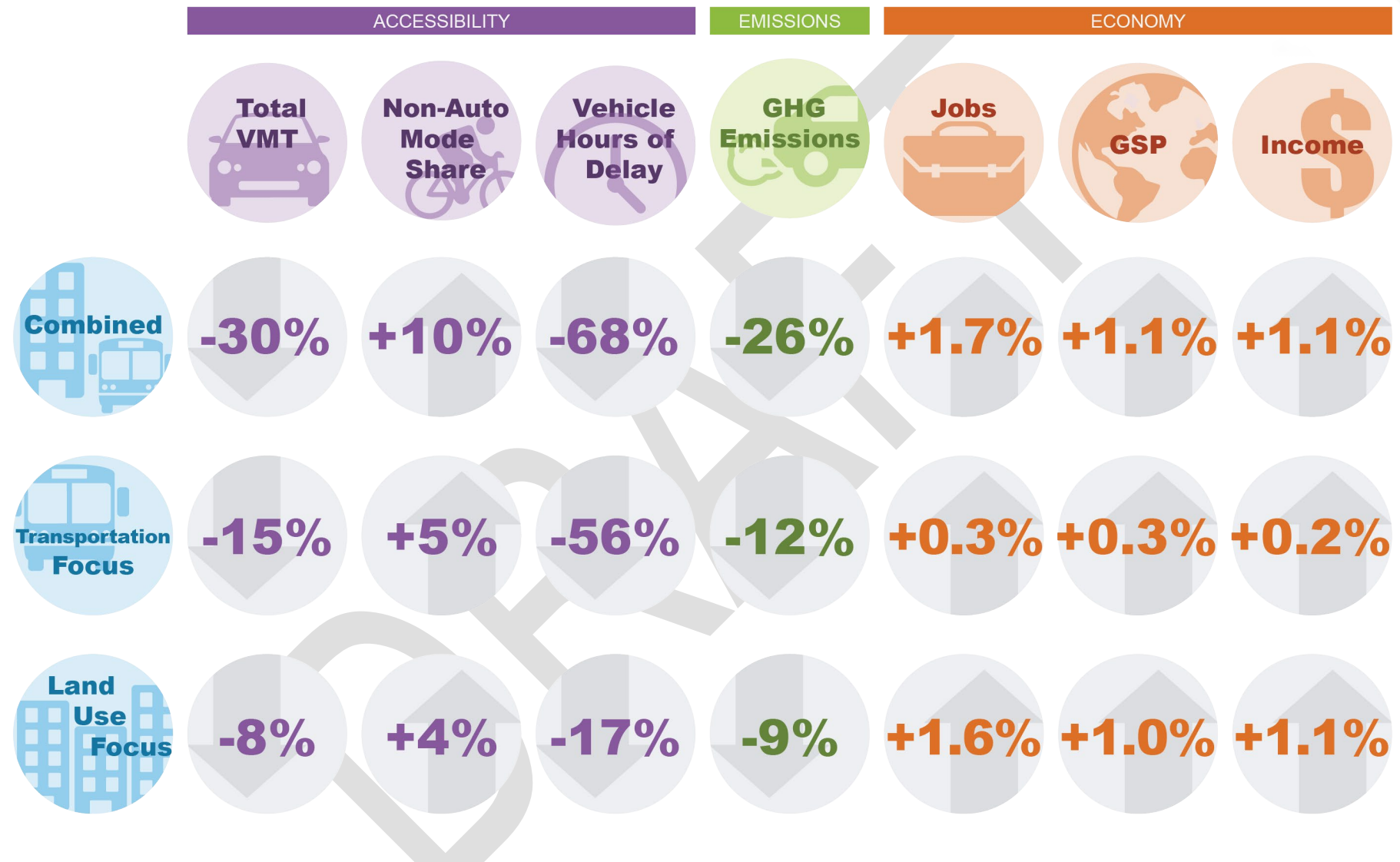
SCENARIO ANALYSIS RESULTS

The scenario analysis revealed that with bold, transformational strategies, we can make significant progress toward achieving our 2050 targets. Summary results of the analysis are shown in Figure 36, followed by a more detailed discussion on each area of performance. Key findings and implications of the scenario analysis include:

- ▶ More efficient land use alone could reduce VMT and GHG emissions by roughly 8 percent from the 2050 Baseline. When combined with the strategies modeled in the transportation focus scenario, the benefits are compounded to a 30 percent reduction in VMT and a 26 percent reduction in GHG emissions, highlighting the importance of integrating transportation and land use planning if we are to reach our goals for 2050.
- ▶ Telework, efficient land use, and roadway pricing^{vi} are the largest contributors to VMT reduction. Since pricing is shown to be a highly effective VMT-reduction strategy, but may place an additional financial burden on low- and middle-income Californians during the current economic recession, the recovery period should be used to conduct further research, exploration, coordination, and collaboration to ensure that any future statewide pricing program advances social equity and is compatible with regional pricing programs being explored by California MPOs.
- ▶ In the Combined scenario, local transit, rail, and shared mobility strategies can achieve an 11 percent reduction in statewide VMT by providing travelers with convenient, affordable transit options that are more efficient than driving. The Combined scenario also results in nearly a quarter of 2050 trips being taken on foot, by bike, or on transit—an increase of 10 percentage points over the 2050 Baseline. To incentivize this mode shift, the state and its partners will need to invest strategically in transit, rail, and shared mobility options, as well as active transportation infrastructure that supports first-last mile access.
- ▶ Even with stringent regulations, CAVs are expected to lead to a seven percent increase in VMT, highlighting the need for strong regulatory action to ensure future technologies support our accessibility goals.
- ▶ VMT reduction strategies in the combined scenario would result in a 68 percent reduction in VHD, allowing Californians to spend less time in their vehicles, and more time with family, friends, recreating, or at work.
- ▶ The economic benefits of transportation improvements are relatively small compared to the overall size of California's economy; however, in the combined scenario, California would see an additional half million jobs, \$33 billion in household income, and \$51 billion in gross state product over the 2050 Baseline due to investments in transportation infrastructure and more efficient movement of people and goods.
- ▶ The 2050 Baseline scenario assumes regionally-adopted roadway capacity enhancements identified in RTP/SCS's are completed by 2050, although these are likely to increase VMT and GHG emissions from current levels, and could make achieving State GHG reduction targets more difficult.

^{vi} The analysis does not distinguish between the various types of roadway pricing. Roadway pricing in this context refers to the increase in auto-operating costs modeled as part of the scenario analysis.

FIGURE 36 SCENARIO ANALYSIS RESULTS (2050 MPO FORECASTS)



Source: Accessibility measures are from the CSF2TDM, emissions measures are from the Vision model, and economic measures are from TREDIS.

Note: All results are shown as the percent change from the 2050 Baseline, while the non-auto mode share is shown as the increase in percentage points from the 2050 Baseline to each scenario.

GHG Emissions Reduction

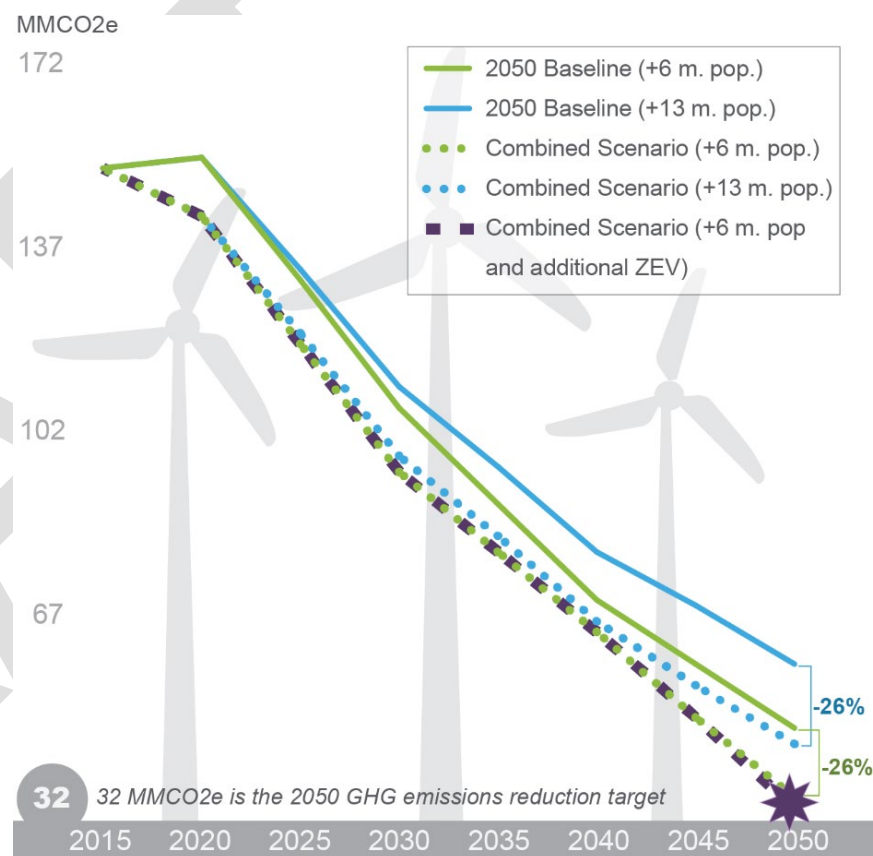
In 2015, transportation emissions totaled approximately 151.5 million metric tons of CO₂ equivalents (MMCO₂e). SB 391 requires the CTP 2050 to demonstrate how California's future transportation system will support the goal of reducing transportation sector GHG emissions to 80 percent below 1990 levels by 2050, to about 32 MMCO₂e. This is an ambitious target that will require a full range of improvements to achieve.

Both the 2050 Baseline and the Combined Scenario show a significant downward trajectory in emissions due to improved fuel efficiency and fleet mix assumptions asserted in the Climate Change Scoping Plan. If the Combined Scenario strategies are implemented, and 2050 population reaches the nearly 45 million forecasted by the DOF, emissions could be lowered to 34.4 MMCO₂e by 2050.

Figure 37 shows that with only a small increase in ZEV adoption beyond what is estimated in the Climate Change Scoping Plan, California would reach the 2050 target of 32 MMCO₂e.^{vii} The specific ZEV adoption rates needed to reach GHG reduction targets are presented in Table 2. California is already making steady advancements toward statewide GHG emissions reduction. In June 2020, CARB adopted the Advanced Clean Trucks rule, which sets a goal of making all new trucks sold in California zero-emission by 2045. Another CARB mandate requires that all transit buses be zero-emission by 2040.

While achieving a small increase in ZEV adoption over the Climate Change Scoping Plan may seem a minor feat, just achieving the fleet mix called for in the Scoping Plan will require a monumental effort. The CTP 2050

FIGURE 37 GHG EMISSION REDUCTION (MPO VS. DOF POPULATION FORECAST COMPARISON)



Source: Vision model.

Note: Upper bound reflects CSF2TDM 2050 population forecasts, while lower bound reflects 2030 interim forecasts, which are consistent with the revised 2050 forecasts from the Department of Finance.

^{vii} The Climate Change Scoping Plan includes multiple policies and measures to reduce GHG emissions and criteria air pollutants. Estimates for 2050 ZEV fleet mix were sourced from CARB's 2016 Mobile Source Strategy, which is included in the Climate Change Scoping Plan.

recommendations support ZEV adoption through policies focused on vehicle electrification and shifting travel behavior to support emissions reduction (see Chapter 5).

TABLE 2 ZERO-EMISSION VEHICLE ADOPTION RATES NEEDED TO REACH 2050 TARGETS

Vehicle Type	Climate Change Scoping Plan ZEV Estimates for 2050	ZEV Fleet Mix Needed to Reach 2050 Emissions Reduction Targets	Difference Between Climate Change Scoping Plan and % ZEV Needed to Reach 2050 Emissions Reduction Targets
Passenger Vehicles	65%	68%	3%
Light- and Medium-Duty Trucks	20%	26%	6%
Heavy-Duty Trucks	5%	12%	7%

Source: 2050 ZEV population estimates from CARB Mobile Source Strategy.

Accessibility Benefits

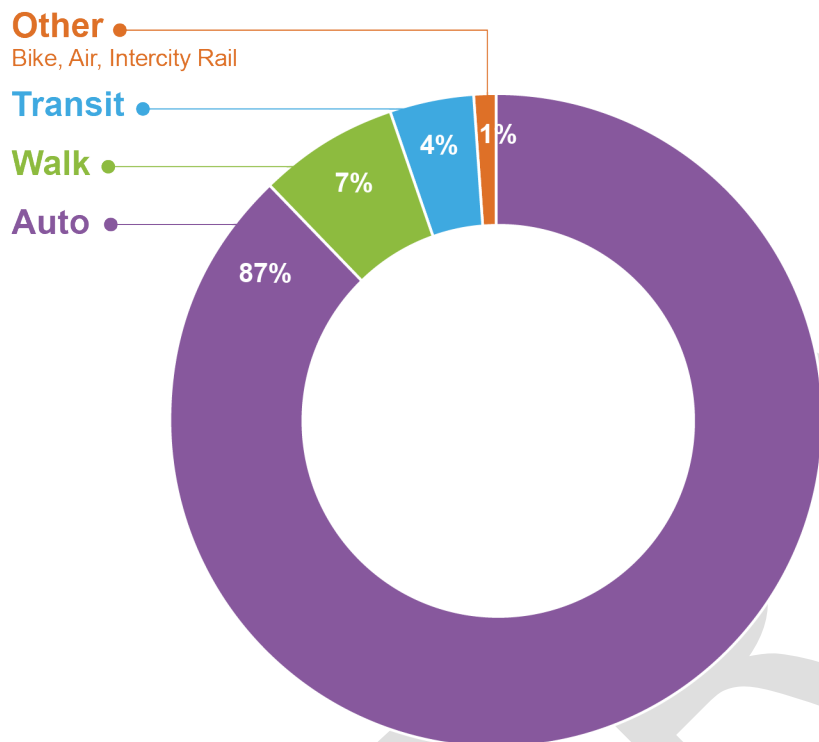
Accessibility refers to the ease by which people and goods can reach their destinations. Accessibility suffers when congestion and delay increase, both of which are a function of VMT. Accessibility improves when people have a range of high-quality transportation options, and when destinations are closer together. Reduced VMT and increased use of non-auto modes means less congestion on our roadways, and better access to destinations.

Non-Auto Mode Shift

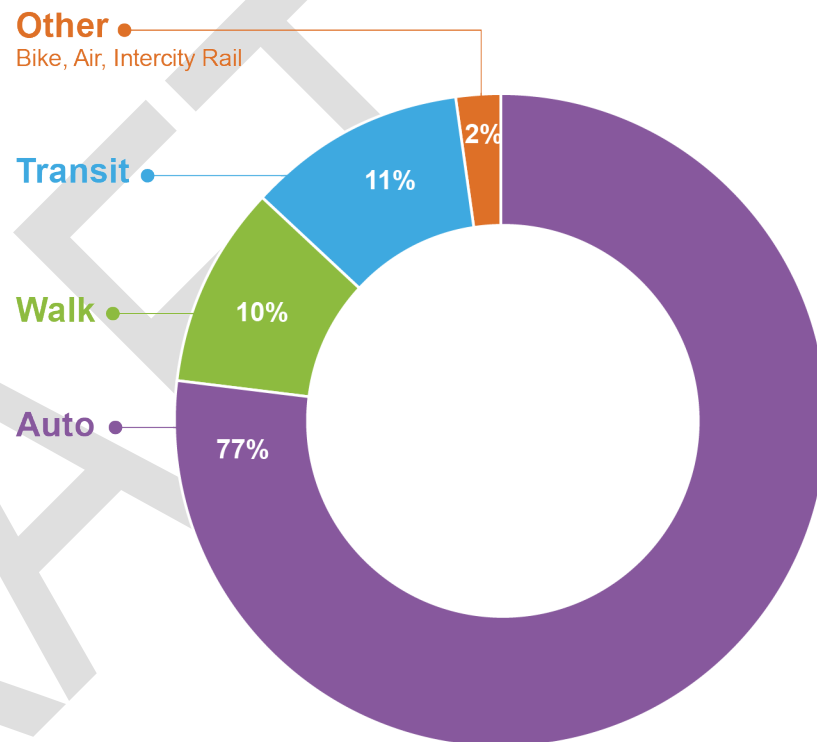
The Combined scenario results in a significant shift toward non-auto modes, with 23 percent of trips occurring by biking, walking, transit, or other non-auto modes by 2050, compared to 13 percent under 2050 Baseline conditions (Figure 38). Expanded walking, biking, and transit use yields proven economic and environmental benefits, and supports improved public health and quality of life in California communities.¹⁰⁸ Making non-auto modes safe, convenient, and affordable to support this shift, is a core recommendation of the CTP 2050 discussed further in Chapter 5.

FIGURE 38 MODE SHARE (2050 BASELINE VS. COMBINED SCENARIO)

2050 BASELINE MODE SHARE



COMBINED SCENARIO MODE SHARE



Source: CSF2TDM.

Vehicle Miles Traveled

Without intervention, VMT on California roadways could increase by up to 35 percent by 2050. Implementing the strategies in the Combined Scenario could lead to a 30 percent reduction in VMT from the 2050 Baseline (Figure 39). This equates to fewer miles driven per person from 23 per day in the 2050 Baseline to only 16 per day in the Combined Scenario (Figure 40). The reduction in VMT is primarily driven by the assumption that more people will be teleworking, the cost of driving will increase in congested areas (for the top 75 percent of earners), and that future land use will be more compact in 2050, as shown in Figure 41. Given the current economic recession and social equity implications of road pricing and other modeled strategies, full implementation of these VMT-reduction measures is not recommended in this plan. Chapter 5 describes how we can maximize VMT reduction while supporting other CTP 2050 goals of health, safety, and quality of life.

FIGURE 40 COMBINED SCENARIO VMT PER CAPITA

VMT PER CAPITA

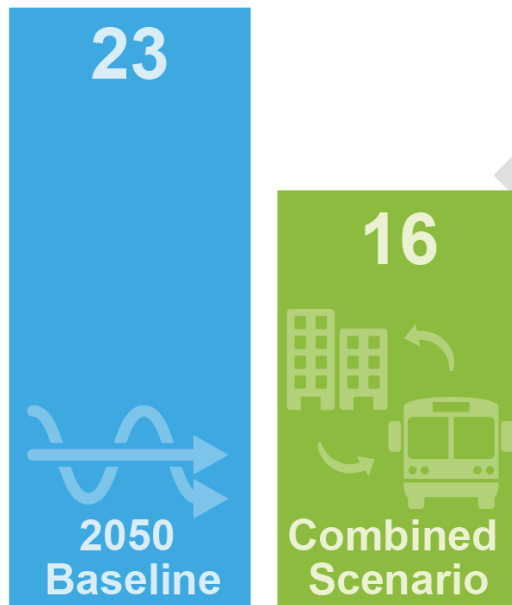
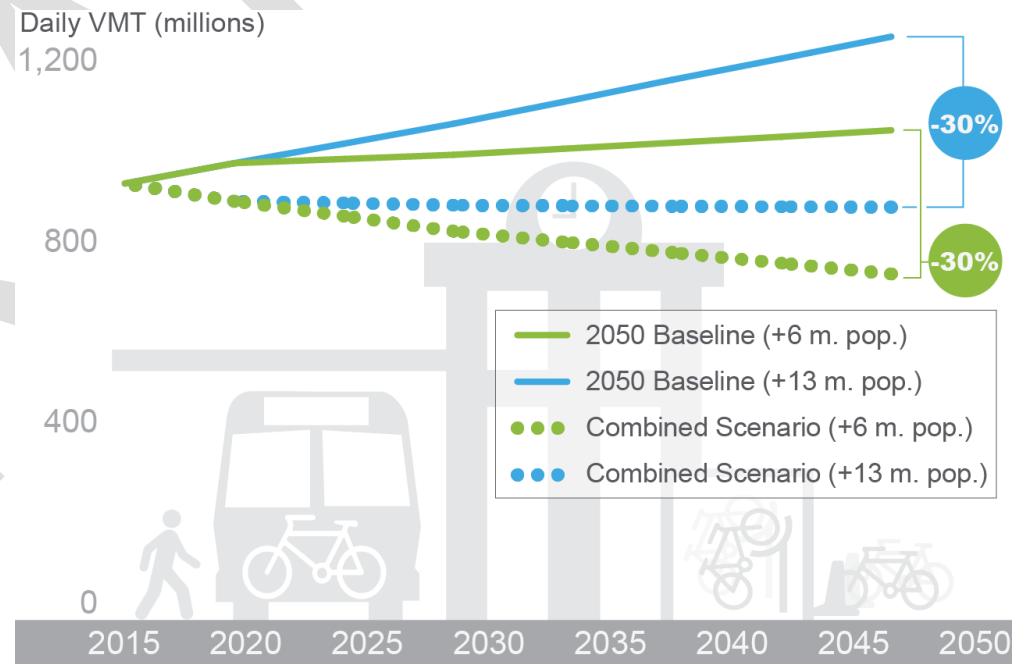
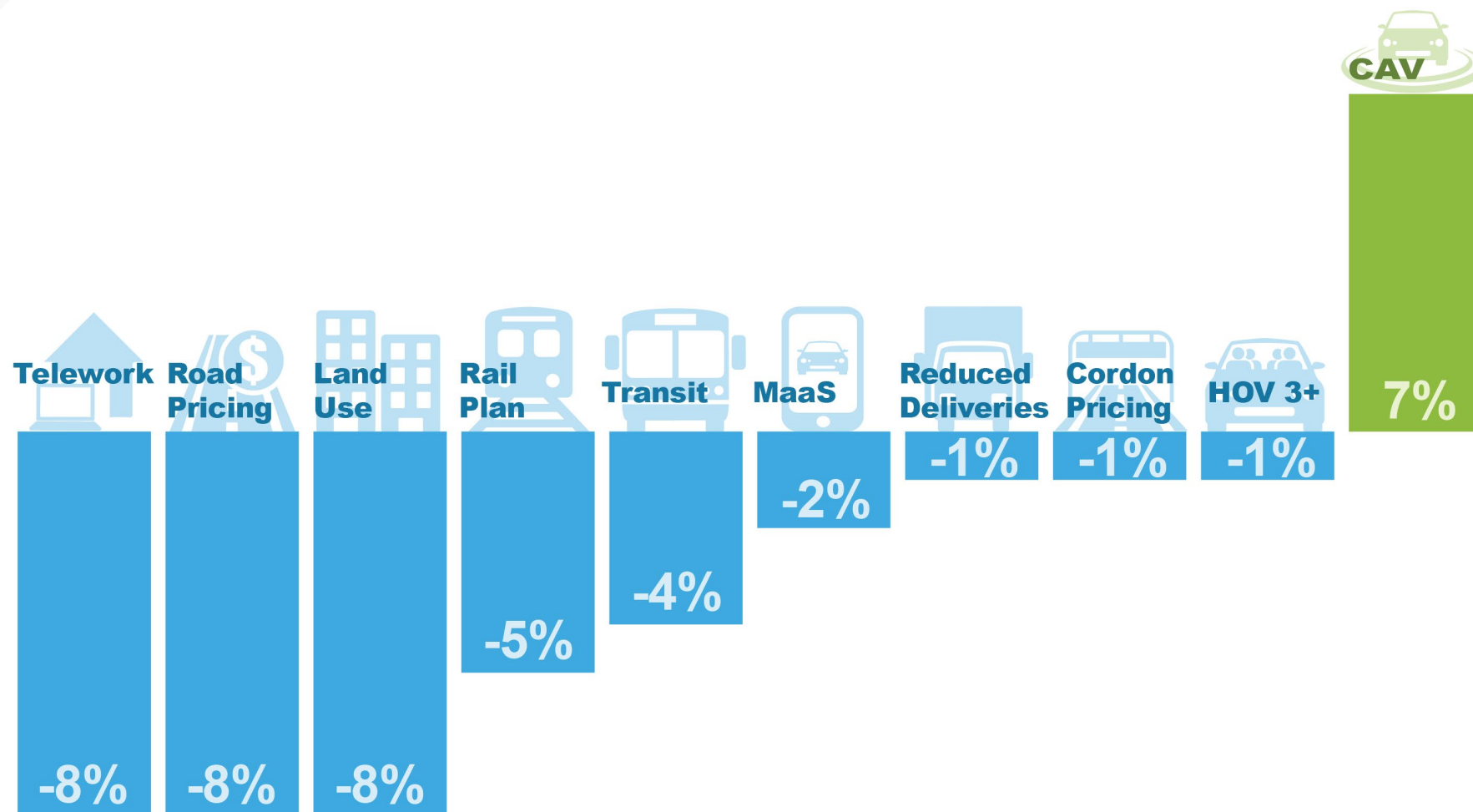


FIGURE 39 VMT REDUCTION (MPO VS. DOF POPULATION FORECAST COMPARISON)



Source: CSF2TDM.

FIGURE 41 COMBINED SCENARIO VMT REDUCTION BY STRATEGY



Source: CSF2TDM.

Note: This figure represents an estimate.

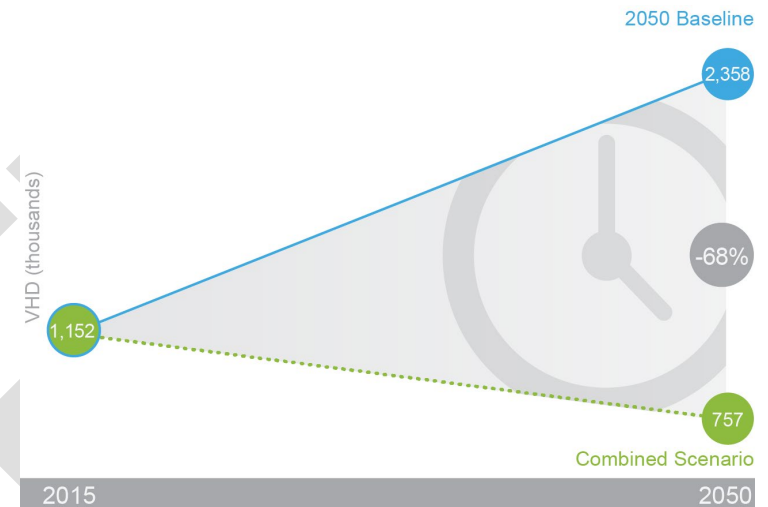
Delay

The Combined Scenario improvements could yield a 68 percent reduction in vehicle hours of delay from the 2050 Baseline, offering Californians less time stuck in traffic and more time spent with family and friends (Figure 42). Additional strategies that incentivize mode shift and more efficient use of vehicles and roadway capacity will be essential to achieving these results.

Economic Benefits

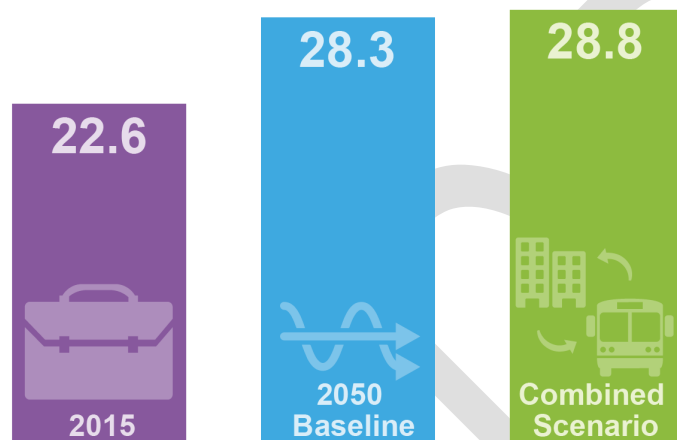
The economic recession brought on by COVID-19 has caused unemployment and loss of income for many Californians already struggling with the rising cost of living. As discussed in Chapter 2, transportation investments can stimulate economic growth. The economy benefits from reduced roadway delay, shifting local travel toward transit, walking, and biking, and shifting interregional travel away from cars,

FIGURE 42 VEHICLE HOURS OF DELAY (THOUSANDS)



Source: CSF2TDM.

FIGURE 43 JOB GROWTH (MILLIONS)



Source: TREDIS.

trucks, and airlines and

toward passenger and freight rail. Many of these shifts can be made possible by reinvesting road pricing revenues into expanded mobility options.^{viii} The economic benefits of the combined scenario improvements amount to an additional half-million new jobs statewide by 2050, an additional \$33.3 billion in new income for California employees, and an additional \$51 billion in gross state product.^{ix}

Job Growth

The Combined scenario improvements would add an additional 482,000 jobs to California's economy by 2050, a 1.7 percent increase over the 2050 Baseline. These are primarily construction jobs created through investments in infrastructure.

^{viii} Road pricing is not recommended during economic recession. The results in this section reflect analysis that was completed prior to the onset of COVID-19.

^{ix} These benefits are based on MPO population forecast for 2050.

Income Growth

The Combined scenario would generate an estimated \$33.3 billion in new income for California employees, an increase of one percent from the 2050 Baseline. The average new wage per new employee in 2050 under the combined scenario is an inflation-adjusted \$69,000 per year, a 35 percent increase from the 2015 average wage of \$50,750.¹⁰⁹ The new jobs created in the combined scenario would be evenly distributed between high wage and low wage sectors. Strategically crafted policies can support job growth in the middle and higher wage occupations through targeted investments and additional workforce training.

Gross State Product (GSP)

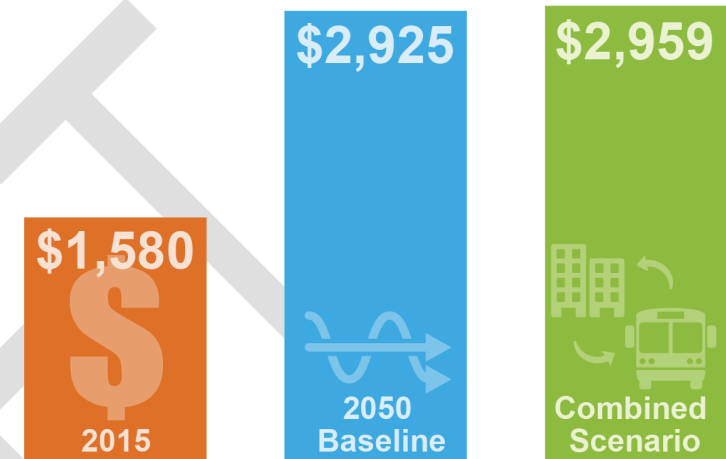
GSP is a measure of California's total economic output from all industries. While transportation investments are small compared to California's total GSP, the combined scenario would result in an additional \$51 Billion in GSP, bringing more business, jobs, income, and tax revenues to California communities.

Developing Recommendations

The findings of the modeling analysis provide important insights as to how far certain strategies can go toward helping us reach our goals. But as noted in the opening of this Chapter, there are hundreds of strategies that cannot be evaluated quantitatively, including those centered on social equity, public health, and quality of life. These strategies were evaluated qualitatively to determine their ability to further the CTP 2050 vision and goals, as well as readiness for implementation. The screening factors are shown in Figure 46.

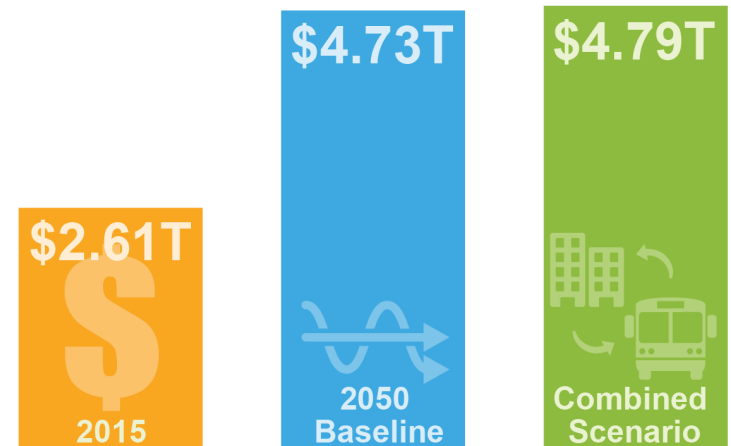
The onset of COVID-19 in March 2020 caused drastic changes to transportation needs and priorities. To account for these changes, the CTP 2050 team conducted an additional screening process to evaluate the effectiveness of plan recommendations in two post-COVID-19 recovery scenarios. The methodology for this process is summarized below, with the full methodology available in the Technical Analysis Element.

FIGURE 44 INCOME (BILLIONS)



Source: TREDIS.

FIGURE 45 GROSS STATE PRODUCT (TRILLIONS)



Source: TREDIS.

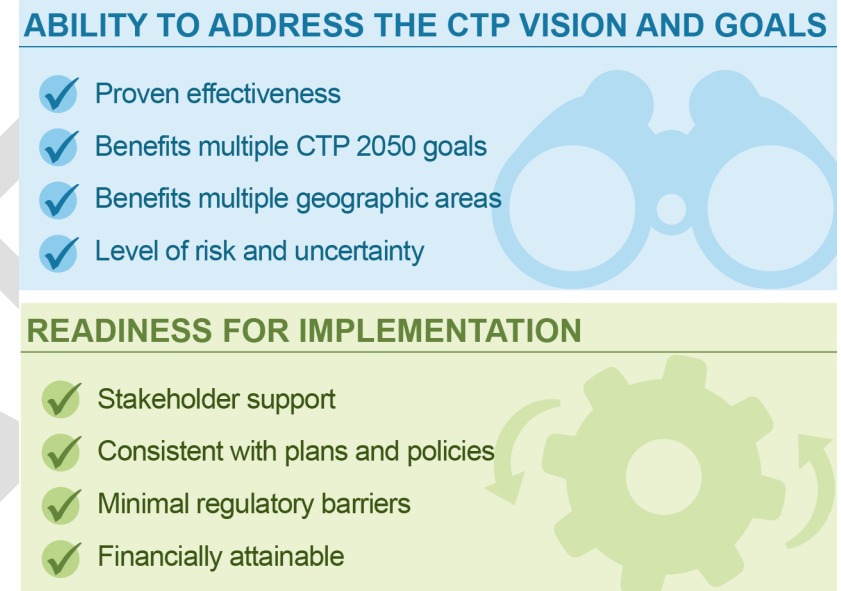
COVID-19 Recovery

To address the significant uncertainties caused by COVID-19, a second process evaluated the benefits of CTP 2050 recommendations under a range of potential paths to recovery, each of which considers alternate rates of economic growth and changing travel preferences. In addition to a **Rapid Recovery** scenario, which assumes the state recovers quickly and reflects assumptions used in the CTP 2050 modeling process, two additional paths to recovery were explored:

1. **Moderate Recovery**, in which COVID-19 affects household travel and the state economy in the short term, but the economy recovers from the downturn along a more modest growth trajectory. In this scenario, the economy remains global, but local economic stability improves in the mid to long term, as manufacturing and supply chains adapt to become more localized and resilient to future disruptions. Over time, people once again use air travel, transit, and shared mobility at near pre-coronavirus levels. Meanwhile, people continue to bike and walk more regularly, and telework and other digital substitution of trips (e.g., online shopping, telehealth, distance learning) remain very common given their convenience and proven success during the COVID-19 crisis.
2. **Prolonged Recovery**, in which COVID-19 or other disruptions become a regular occurrence, limiting economic growth over an extended time period, and resulting in persistent social distancing measures. In this scenario, California small businesses may suffer as Californians become more reliant on multinational companies with economies of scale and the strongest supply chains, and California businesses can sell fewer goods out-of-state. Continued apprehension about transit and shared mobility travel results in increased reliance on single-occupant vehicle travel for those who can afford it. Biking and walking become increasingly popular for both travel and recreation. High unemployment lowers household income and widens the wealth gap, intensifying equity concerns.

The dozens of CTP 2050 recommendations and supportive actions developed prior to COVID-19 were reassessed for their relevance under all three recovery paths. Where appropriate, actions were amended to ensure they respond effectively to these alternate conditions. Additional actions were identified to address specific risks of COVID-19 revealed by this evaluation process, including supporting essential workers and services, expanding broadband and addressing the digital divide, and providing emergency funding to transit agencies. Chapter 5 presents the recommendations that emerged from this process. The Technical Analysis Element contains a detailed description of the methodology used to develop and refine recommendations.

FIGURE 46 SCREENING CRITERIA FOR CANDIDATE CTP 2050 STRATEGIES



5 OUR PATH FORWARD

RECOMMENDATIONS ELEMENT

This chapter presents recommendations to achieve the long-term vision for California's future transportation system, with a short-term focus on helping California communities adapt and recover from the COVID-19 crisis.

So far, the CTP 2050 has explored our most pressing transportation challenges and opportunities, illustrated a unified vision for California's future transportation system, and investigated its expansive benefits. This chapter presents the CTP 2050 recommendations, including programs, policies, and investments, which together represent our best path forward to achieving California's transportation vision. These recommendations were selected through rigorous analysis and stakeholder input to ensure they support the CTP 2050 vision across all goals. While the CTP 2050's purview is long-term, advancing the recommendations in this chapter will also address short-term concerns, such as recovering from the current economic recession while building a more resilient system that better meets the needs of all California communities.


While the CTP 2050 development was led by Caltrans, many of the recommendations require coordination, funding, and oversight across various State, regional, local, and private partners. The roles and responsibilities for implementing each recommendation will be addressed in an Implementation Plan following adoption of the CTP 2050.

RECOMMENDATIONS

The CTP 2050 identified 14 cross-cutting recommendations, which together address each of the goals identified in the CTP 2050 vision (Figure 47). In the following sections, each of the 14 recommendations is introduced, along with numerous supportive actions to help guide implementation. These are separated into **New Actions** that can be implemented in the next five years; and **Continuing Actions**, which continue or build upon existing activities that remain essential to addressing the vision.

FIGURE 47 GOALS SUPPORTED BY CTP 2050 RECOMMENDATIONS

RECOMMENDATIONS:

	 Safety	 Climate	 Equity	 Accessibility	 Quality of Life & Public Health	 Environment	 Economy	 Infrastructure
1 Expand remote access to jobs, goods, services, and education	✓	✓	✓		✓	✓		
2 Expand access to safe and convenient active transportation options	✓	✓	✓	✓	✓	✓	✓	✓
3 Improve transit, rail, and shared mobility options		✓	✓	✓	✓	✓	✓	✓
4 Advance transportation equity			✓	✓	✓		✓	
5 Enhance transportation system resiliency	✓	✓	✓	✓	✓	✓	✓	✓
6 Enhance transportation safety and security	✓		✓	✓	✓			✓
7 Improve goods movement systems and infrastructure		✓		✓		✓	✓	✓
8 Advance Zero-Emissions Vehicle (ZEV) technology and supportive infrastructure		✓				✓		✓
9 Manage the adoption of connected and autonomous vehicles	✓			✓				✓
10 Price roadways to improve the efficiency of auto travel		✓		✓	✓	✓	✓	✓
11 Encourage efficient land use		✓		✓		✓		✓
12 Expand protection of natural resources and ecosystems		✓	✓		✓	✓		
13 Strategically invest in state of good repair improvements	✓		✓	✓				✓
14 Seek sustainable, long-term transportation funding mechanisms	✓	✓	✓	✓	✓	✓	✓	✓

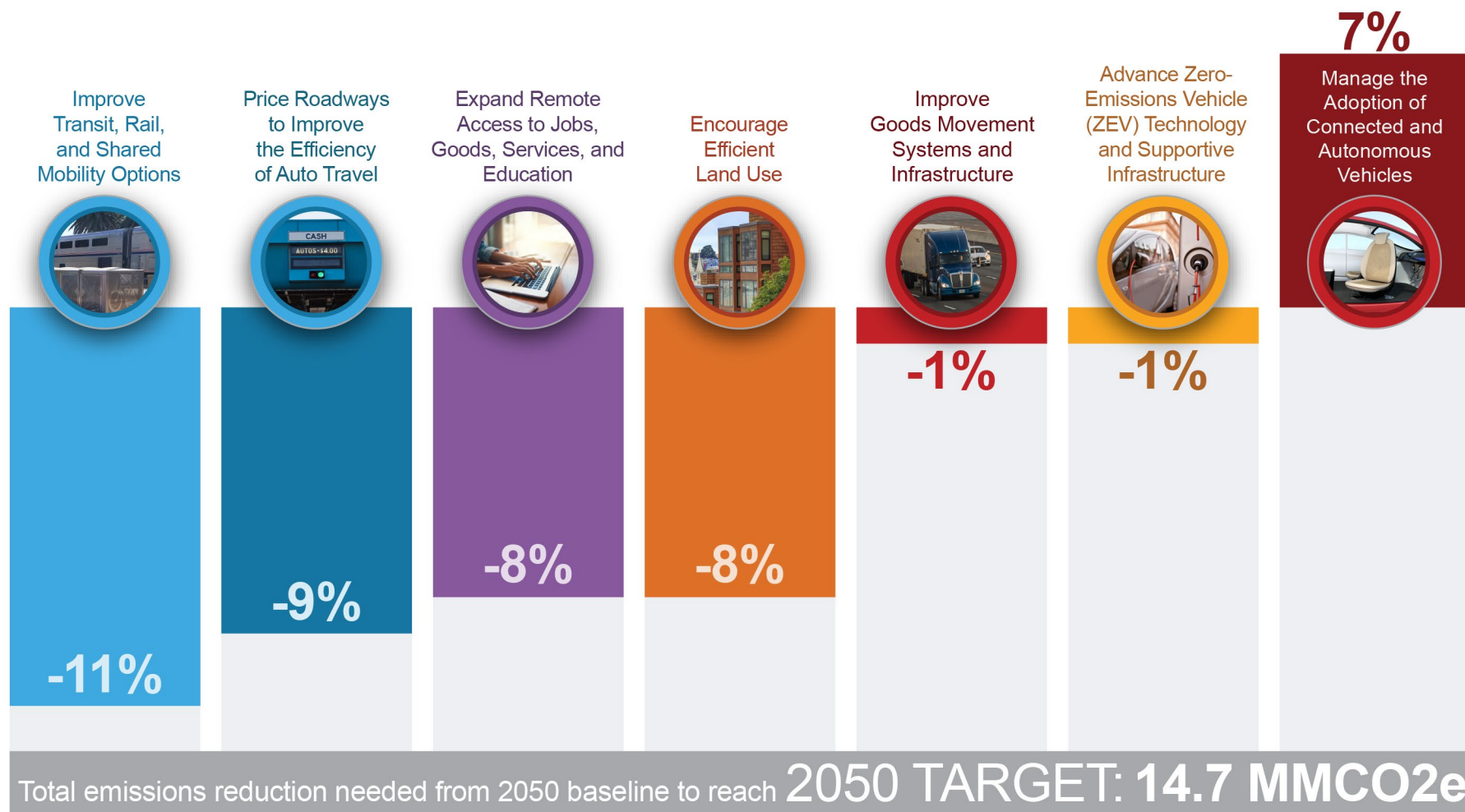
REACHING OUR CLIMATE TARGETS

SB 391 requires the CTP 2050 to demonstrate how California's future transportation system will support the goal of reducing transportation sector GHG emissions to 80 percent below 1990 levels by 2050, to a total of 32 MMCO₂e. To reach this target, we must achieve a reduction of 14.7 MMCO₂e from the 2050 Baseline.^x Figure 48 provides an estimate of the contribution of each CTP 2050 recommendation (where applicable) to the needed reduction.^{xi} In addition to the improvements included in the 2050 Baseline, improving transit, rail, and shared mobility options offers the greatest benefit to GHG emissions reduction, followed by roadway pricing, expanding remote access to jobs, goods, services, and education, and encouraging efficient land use. Since CAVs are anticipated to lead to an increase in VMT, they also pose a risk to reaching GHG emissions reduction targets. The CTP 2050 recommendations account for this increase through the other recommendations.

^x This figure represents the DOF's slower population growth estimate of an additional 6 million Californians by 2050.

^{xi} Only the strategies that were modeled (described in Chapter 4) were included in this assessment.

FIGURE 48 CTP 2050 RECOMMENDATIONS CONTRIBUTION TO GHG EMISSIONS REDUCTION



Note: This figure represents an estimate. It reflects the strategies that were modeled as part of the CTP 2050 scenario analysis, and does not reflect the full scope of recommendations and actions presented in Chapter 5.



Expand Remote Access to Jobs, Goods, Services, and Education

California's response to stay-at-home policies following the COVID-19 crisis highlighted the importance of fast and reliable Internet access as a critical transportation strategy. Virtual platforms allowed people to stay connected to work, school, health care, services, and each other, without requiring a trip at all. The transportation system plays an important role in providing Californians with Internet access. Information communications technologies (ICT) that enable broadband connectivity, such as fiber optics and 5G technology, are often embedded in our transportation infrastructure. "Dig once" policies have already helped ensure that transportation investments go hand-in-hand with

broadband deployment. The CTP 2050 recommends additional inter-agency coordination, planning, and partnerships to strategically advance broadband deployment statewide, especially in rural and underserved areas that have historically lacked high-speed Internet access. Expanding internet access also reduces traffic congestion and vehicle emissions by reducing the total amount of travel throughout the state. These are long-standing priorities which can be supported by increasing telework and integrating smart cities considerations throughout broadband deployment to make better use of existing transportation facilities.

TABLE 3 RECOMMENDATION 1 ACTION ITEMS

	Actions
New	<ol style="list-style-type: none"> 1. Convene a statewide advisory committee to guide and oversee broadband deployment on the transportation system 2. Develop a statewide strategy to accelerate broadband deployment, including a roadmap to digital inclusion that focuses on underserved parts of the State, last-mile ICT in rural areas, and connectivity to essential service institutions such as hospitals and distribution centers 3. Accelerate implementation of transportation projects within the Strategic Broadband Corridors identified by the Department of Technology 4. Study the economic, equity, and travel impacts of a variety of policies and incentives to reduce VMT and promote telework 5. Integrate smart cities considerations into broadband planning and deployment 6. Promote expansion of telework policies for State employees and other public-sector employees who are able to work remotely
Continued	<ol style="list-style-type: none"> 7. Bolster partnerships between transportation agencies, utility providers, internet service providers, and consumers to expand broadband service 8. Expand research on the transportation impacts of increased telework, telehealth, and distance learning over the short and long term, and integrate findings into future transportation, land use, climate, and environmental plans and policies 9. Enhance virtual and other forms of remote public outreach to increase meaningful participation in the transportation planning process



2

Expand Access to Safe and Convenient Active Transportation Options

Providing Californians with access to a range of active transportation options is fundamental to achieving the CTP 2050 Vision. Not only does active transportation provide a healthy and affordable alternative to driving, it has been shown to boost economic activity, create community cohesion, and enhance health and quality of life.¹¹⁰ The increase in biking and walking following COVID-19 highlights just how essential these modes are to our health and mobility.

Every MPO in California has identified one or more SCS that emphasize active transportation, and local communities across the state continue to plan for and invest in safe bicycling and walking options. The CTP 2050 seeks to provide all communities with safe, protected, and connected active transportation infrastructure that is accessible and inviting for users of all ages and abilities.

TABLE 4 RECOMMENDATION 2 ACTION ITEMS

Actions	
New	<ol style="list-style-type: none"> 1. Identify priority actions in Toward an Active CA needed to support and maintain the increase in active travel following COVID-19 2. Expand partnerships with CBOs in marginalized communities to ensure active transportation investments reflect community needs and priorities 3. Revise permitting and standards to provide local and regional transportation agencies with more flexibility to pilot and implement innovative transportation projects, such as “Slow Streets” programs 4. Revise permitting and standards to support local and regional agencies in implementing active transportation projects on state-owned right-of-way 5. Explore partnerships and incentive programs to support expanded use of e-bikes, both for short- and longer-distance travel
Continued	<ol style="list-style-type: none"> 6. Expand funding for active transportation projects at the state, local, and regional level 7. Expand active transportation funding specifically for marginalized communities and center communities in the planning and decision-making process 8. Prioritize projects that include complete streets elements such as protected bicycle lanes, expanded sidewalks, ADA accessible infrastructure, and those that provide first-last mile transit access 9. Require multimodal project components and Complete Streets upgrades during maintenance, preservation, and rehabilitation activities, where feasible 10. Expand statewide campaigns to encourage active transportation and educate both active transportation users and drivers about safety



3

Improve Transit, Rail, and Shared Mobility Options

Transit systems are vital to California communities. While facing abrupt declines in ridership and revenue following COVID-19, transit has remained critical to response and recovery by providing mobility to essential workers and those without other transportation options. Transit agencies adapted quickly to new travel needs by consolidating service, shifting operations, and increasing sanitation on vehicles. But these measures are not

enough—the long-term viability of transit is at risk as service needs continue to outpace revenues. Protecting and enhancing local transit remains a top priority of the CTP 2050. This recommendation calls for expanded funding, resources, and coordination to support California transit agencies through these difficult times. At the same time, we must maintain focus on long-standing priorities of expanding and integrating interregional transit and rail options and expanding use of shared mobility options in order to meet future travel demand.

LOCAL SPOTLIGHT

Sacramento Regional Transit (SacRT)'s RydeFreeRT is a pilot program that offers free transit for youth and students up to grade 12. The program resulted in a 106-percent increase in student ridership from January 2019 to January 2020.



TABLE 5 RECOMMENDATION 3 ACTION ITEMS

	Actions
New	<ol style="list-style-type: none"> 1. Provide emergency State funding to transit agencies facing shortfalls due to COVID-19 2. Explore alternative State, local, and Federal transit funding sources to support transit agencies over the long-term 3. Develop statewide public health standards to reduce the spread of COVID-19 on transit vehicles, such as capacity limitations, thermal screening, no-touch payment, and others. Make these investments eligible for State funding 4. Study the economic and travel impacts of tax benefits and subsidies for those who choose to commute by transit or other non-auto modes 5. Explore the benefits and tradeoffs of universal fare-free transit 6. Develop a statewide strategy for responsible expansion of shared mobility options, particularly in disadvantaged communities
Continued	<ol style="list-style-type: none"> 7. Continue the California Integrated Travel Program (Cal-ITP) to develop statewide standards for fare integration, trip planning, and data reporting 8. Facilitate coordination and information sharing between transit agencies, as well as between transit agencies and private shared-mobility providers 9. Provide subsidies to transit agencies who offer free or reduced fares to low-income, underserved, students and/or other transit-dependent riders 10. Continue to modernize transit systems through ITS elements like signal priority, automatic passenger counters, and real-time traveler information systems 11. Support projects that include bus rapid transit elements and bus only lanes in order to improve transit speed and reliability 12. Identify and prioritize improvements in the 2018 State Rail Plan Vision that can be implemented in the short term



4

Advance Transportation Equity

As discussed in the Call to Action, transportation decisions have directly contributed to racial and economic injustice. The profound impacts of redlining, highway expansion, and exclusionary zoning have left Black and Brown communities with fewer housing and transportation options; lower access to jobs, services, healthy food, and recreation; and heightened exposure to air pollution and traffic incidents. Many of these impacts are furthered through redevelopment, gentrification, and displacement—which continue to occur throughout California communities. To advance transportation equity, we must identify and reform these and transportation policies that

perpetuate injustice, such as highway and freight planning and traffic enforcement. The CTP 2050 also calls for correcting historic transportation decisions by actively prioritizing resources, support, and funding for communities who have endured the greatest burdens of the transportation system, and who continue to lack safe, convenient, and affordable mobility options. These actions must center marginalized communities throughout the decision-making process, providing resources, guidance, and support to implement projects that correct for historic and existing disparities.

TABLE 6 **RECOMMENDATION 4 ACTION ITEMS**

	Actions
New	<ol style="list-style-type: none"> 1. Launch a comprehensive statewide effort to identify and reform existing transportation policies that uphold racial and economic injustice, including traffic enforcement practices 2. Prioritize investments in disadvantaged communities to improve mobility and access to jobs, education, health care, services, and recreation. Ensure that investments are aligned with community-identified transportation needs and paired with anti-displacement policies 3. Establish a statewide advisory committee tasked with expanding action around racial equity and transportation. Task the committee with developing a racial equity analysis framework to guide investment decision-making 4. Support local agencies in linking anti-displacement policies such as tenant protections, affordable housing production, and affordable housing preservation to transportation investments 5. Explore a transportation tax credit or other incentive for qualified low-income Californians
Continued	<ol style="list-style-type: none"> 6. Expand funding, resources, and partnerships with equity focused CBOs, community cosponsors, and community-led transportation initiatives 7. Remove barriers to participation in transportation planning and decision-making within marginalized communities 8. Expand funding, coordination, and collaboration with Tribal governments 9. Remove barriers to clean transportation options for low-income residents by implementing the actions in the SB 350 Barriers Study 10. Build on USDOT's Ladders of Opportunity program to strengthen workforce training and job opportunities in the transportation sector, particularly in the low-carbon economy



5

Enhance Transportation System Resiliency

A resilient transportation system is one that can effectively provide mobility to people and goods in the face of uncertainty, either from climate change, earthquakes, natural disasters, pandemics, or other disruptions. Enhancing resilience involves understanding future risks, developing mitigation and adaptation plans to address them, and implementing plans with the input and support of communities. This recommendation aims to promote a culture of resilience that enables quick recovery to unanticipated disruptions, and one that can adapt to withstand the impacts of sea-level rise and other climate change-related severe weather events. State and local governments are already

utilizing scenario planning, risk analyses, and vulnerability assessments to manage the risks posed by climate change. The CTP 2050 calls for expanded funding for implementing state, local, and regional climate mitigation and adaptation plans, such as the Caltrans District Vulnerability Assessments; increasing multi-jurisdictional collaboration on resiliency and adaptation efforts; creating a statewide transportation risk management plan; and increasing access to data, technical tools, and information sharing to make communities stronger and more resilient to future disruptions.

TABLE 7 RECOMMENDATION 5 ACTION ITEMS

	Actions
New	<ol style="list-style-type: none"> 1. Seek new funding sources to address the growing risks of climate change, pandemics, earthquakes, and other natural disasters 2. Develop and maintain a statewide transportation risk management plan to identify and respond to future disruptions 3. Develop a statewide repository of location-specific adaptive strategies that can be incorporated into infrastructure maintenance and rehabilitation projects 4. Identify and prioritize deployment of resiliency strategies in the state's most vulnerable communities 5. Integrate natural land, resource, and ecosystem protection strategies into resiliency planning 6. Increase the use of simulation systems and predictive technologies to understand how future disruptions may impact infrastructure and travel patterns
Continued	<ol style="list-style-type: none"> 7. Develop statewide performance measures on resiliency and include resiliency as a criterion in statewide project prioritization and funding allocation 8. Increase collaboration and communication with MPOs around resiliency planning and integrating resiliency into SCSs 9. Accelerate implementation of the Caltrans District Vulnerability Assessment recommendations 10. Expand adaptation planning grants for local and regional partners and support implementation 11. Expand funding for seismic retrofits of bridges, highways, rail, airports and other infrastructure 12. Preserve and enhance critical access routes for emergency response



6

Enhance Transportation Safety and Security

Ensuring the safety and security of people as they navigate California's transportation system is a top priority of the CTP 2050. This plan builds on the numerous actions identified through the

Strategic Highway Safety Plan, Zero Traffic Fatalities Task Force, and the breadth of regional and local Complete Streets Plans and Vision Zero initiatives across the state. In implementing these actions, it is critical to acknowledge that safety means different things to different people. Expanding outreach and coordination to ensure that diverse voices and perspectives are reflected throughout safety planning and project implementation is a critical step in advancing equity in our communities.

Critical safety actions include reducing driving speeds, ensuring that infrastructure is safe for vulnerable users such as bicyclists, pedestrians, and people with disabilities, and reducing the occurrence of distracted and impaired driving.

Another part of making our transportation system safer and more secure is preparing for the potential safety impacts of new and emerging technologies. While technologies such as CAVs hold promise for reducing human errors in driving, they may also lead to heightened conflicts between CAVs and other roadway users (such as bicyclists and pedestrians) and growing personal and cybersecurity risks. Anticipating and preparing for these risks is a critical step in ensuring safety now and on the future transportation system.

The Strategic Highway Safety Plan

is a comprehensive statewide effort to reduce fatalities and serious injuries across all modes and on all public roads. The SHSP addresses engineering, enforcement, education, emergency response, and emerging technologies.

The SHSP Implementation Plan was last updated in December 2019.

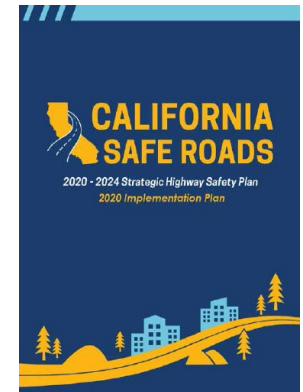


TABLE 8 RECOMMENDATION 6 ACTION ITEMS

Actions	
New	1. Reduce speed limits by repealing the 85 th percentile speed limit rule and enabling local transportation agencies to establish lower speed limits
Continued	2. Expand funding for implementation of safety plans at the state, local, and regional level, including Complete Streets, Safe Routes to School, and Vision Zero plans 3. Prioritize safety improvements within current and historically disadvantaged communities 4. Expand outreach and coordination to better understand and address varying transportation safety needs across race, ethnicity, age, income, gender, sexual orientation, and ability 5. Promote infrastructure design that enhances safety for vulnerable roadway users such as bicyclists, pedestrians, scooters, people with disabilities, and other users of non-auto modes of transportation 6. Reduce driving speeds through infrastructure design 7. Expand education and countermeasures to reduce distracted and impaired driving 8. Expand research around the potential safety benefits and risks associated with new and emerging transportation technologies 9. Investigate technology applications to improve critical infrastructure security monitoring and reduce potential threats



Improve Goods Movement Systems and Infrastructure

California residents and businesses rely on the goods movement system to access the global marketplace. A robust, multimodal, and sustainable freight system is fundamental to our economic well-being and quality of life. The supply chain disruptions that occurred during COVID-19 highlighted the limitations of our current international freight system. The CTP 2050 recommends actions to improve the resiliency and diversification of our goods movement system, including strategically expanding freight capacity to manage future demand, leveraging data and advanced freight technologies, and enhancing supply chain resilience to disruptions. Over the last decade, the increased prevalence

of ecommerce and home deliveries, autonomous trucking and warehousing, and innovative clean freight technologies have evolved the freight landscape. Consistent with the CFMP and Sustainable Freight Action Plan, the CTP 2050 aims to leverage these innovations to move goods more effectively, while reducing the negative health and environmental impacts caused by our freight system.

TABLE 9 RECOMMENDATION 7 ACTION ITEMS

	Actions
New	<ol style="list-style-type: none"> 1. Research the transportation implications of global trade fluctuation and supply chains disruptions and identify infrastructure priorities needed to mitigate risk 2. Integrate freight considerations into travel demand management strategies such as roadway pricing and express lane systems 3. Explore infrastructure and operational strategies to meet demand for deliveries post-COVID-19, including research into the benefits and tradeoffs of drone deliveries, bike delivery services, staging areas, loading zones, and pick-up centers 4. Identify and reform existing policies that pose barriers to innovating the goods movement system and advancing freight technologies 5. Identify and reform existing policies that concentrate freight land uses near low-income communities of color 6. Explore strategies to shorten local and regional supply chains to strengthen local economies and increase resilience to natural disasters, pandemics, and other disruptions
Continued	<ol style="list-style-type: none"> 7. Strategically expand multimodal freight capacity by implementing the strategies identified in the California Freight Mobility Plan 8. Expand the State's ability to manage critical supply chains during emergencies to centralize response 9. Prioritize community health by supporting implementation of clean freight technologies such as zero-emission trucks, alternative fuel infrastructure, clean fuels for jets, ships, and freight-related equipment, and other actions identified in the Sustainable Freight Action Plan 10. Expand and improve truck parking facilities. Build future truck parking facilities away from neighborhoods to reduce community exposure to air pollution and ensure that future facilities are equipped with electric charging infrastructure



8

Advance Zero-Emissions Vehicle (ZEV) Technology and Supportive Infrastructure

While much will change over the coming decades, Californians will still be driving in 2050. In order to reach our 2050 climate goals, we must continue to advance clean fuel technologies, including ZEV technology and supportive infrastructure. ZEV technologies refer to three different vehicle types - battery electric vehicles,

hydrogen fuel cell vehicles, and “transitional” plug-in hybrid electric vehicles—all of which can support the goal of reducing emissions. CARB has authored numerous plans and programs aimed at reducing GHG emissions statewide, including the Climate Change Scoping Plan and Mobile Source Strategy, which focus heavily on expanded uptake of ZEVs. Careful and coordinated implementation of these plans represent the best path toward achieving 2050 GHG emission reduction targets. The CTP 2050 aims to support these efforts, and move ZEV adoption beyond future predictions, by fostering close partnerships across public- and private-sector entities and supporting strategic investments in ZEV-supportive infrastructure and programs.

California's ZEV Action Plan details a strategy to build hydrogen fueling stations and electric vehicle chargers statewide, supporting 5 million ZEVs on California roads by 2030.

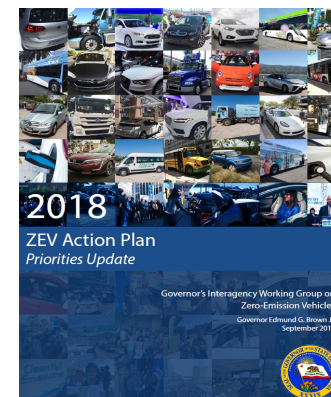


TABLE 10 RECOMMENDATION 8 ACTION ITEMS

	Actions
New	1. Require TNCs and other car-sharing services to transition to electric vehicle fleets consistent with the statewide rate of electric vehicle adoption
Continued	2. Implement the ZEV Action Plan, Vehicle-Grid Integration (VGI) roadmap, and other state plans related to ZEV adoption 3. Accelerate the conversion of Government-owned vehicle fleets to ZEVs 4. Identify and pursue opportunities to make the public right-of-way available for ZEV charging infrastructure 5. Expand California's designated Alternative Fuel Corridors to support strategic placement of charging stations for electric, hydrogen-fuel cell, and natural gas-powered vehicles 6. Coordinate with local land use authorities to support ZEV charging at residential developments, job centers, and public buildings 7. Expand cross-agency coordination and collaboration at the State, regional, and local level, as well as with neighboring states to develop an interstate network of ZEV charging infrastructure 8. Incentivize ZEV adoption by expanding rebate and vehicle buy-back programs



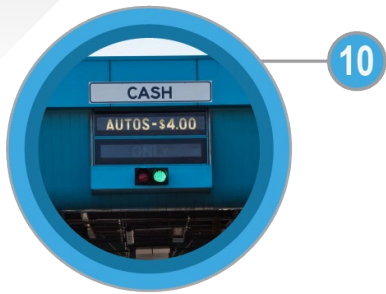
Manage the Adoption of Connected and Autonomous Vehicles

Connected and autonomous vehicles (CAV) technology is developing rapidly, with many California auto-makers leading innovation. Some studies have predicted that CAV technology will become common in vehicles and on the road within decades. CAVs could provide people with safer, more comfortable travel; but could increase VMT by up to 33 percent by incentivizing auto travel. Despite a growing body of research around the impacts of CAVs, many uncertainties remain as to how they will impact land use, equity, travel behavior, goods movement, and emissions. At the same time, automated buses, trucks, and other equipment may become the norm over the coming decades. The

actions outlined in this plan call for expanded research to better understand the impacts of CAVs, as well as proactive policy interventions to ensure they support long-term goals of safety, equity, and accessibility. As travel reverts to pre-COVID-19 levels, linking CAV adoption with pricing strategies, transit investments, and other accompanying policies, will be critical to minimizing CAV's risks to increasing VMT, while maximizing their benefits of improved safety and enhanced mobility, particularly for older adults and people with disabilities.

TABLE 11 RECOMMENDATION 9 ACTION ITEMS

Actions	
New	<ol style="list-style-type: none"> 1. Pursue statewide legislation to ensure CAVs are shared, electric, support efficient land use, and are aligned with the automated vehicle key principles for healthy and sustainable communities identify by the California Office of Planning and Research (OPR) 2. Pursue policies that expand CAV access to aging and youth populations, underserved communities, unbanked and low-income users, and users with disabilities 3. Explore the benefits and tradeoffs of using autonomous buses, trucks, and other essential vehicles to better enable social distancing
Continued	<ol style="list-style-type: none"> 4. Expand research to better understand impacts of CAVs on personal mobility, freight mobility, transportation system performance, land use, and emergency response 5. Expand cross-agency coordination and collaboration at the State, regional, and local level, as well as with neighboring States to ensure smooth operation and deployment of CAV technologies



Price Roadways to Improve the Efficiency of Auto Travel

Roadway pricing is gaining global momentum as a strategy to reduce traffic congestion while providing sustainable long-term funding for the transportation system. Chapter 4 showed that roadway pricing—whether through congestion pricing, tolling, parking pricing, or cordon pricing—is one of the most effective strategies for reducing statewide VMT and GHG emissions. At the same time, roadway pricing raises serious equity concerns. Without mitigation, increasing the cost of driving will place an additional burden on those already struggling with rising housing and transportation costs, and those who have no alternatives to driving. That’s why the CTP 2050

recommends that any pricing program in California—whether at the state, local, or regional level—prioritize social equity through means-based fee structures, exemptions, tax deductions, and/or other mitigations.

The dual priorities of reducing VMT and GHG emissions over the long-term while advancing social equity, especially in the aftermath of COVID-19, prompted us to explore the question: can California have an equitable roadway pricing system? The short answer is—yes. As discussed in Chapter 4, the CTP 2050 analysis explored the impacts of increasing the cost of driving in California’s most congested counties (exempting the lowest income quintile) and implementing cordon pricing in California’s ten most populous downtowns. This results in a positive economic impact for two reasons. First, as travelers shift from driving to other modes, reduced congestion allows for faster and more efficient travel for those who rely on roadways, including freight vehicles. Second, revenues that are reinvested in alternatives to driving, such as rail, transit, and active transportation infrastructure make these options more convenient, accessible, and affordable to the majority of travelers.

Despite these improvements, there is still an immediate impact on disposable income when the cost of driving increases that must be considered.

BEST PRACTICE: VANCOUVER MOBILITY PRICING STUDY

This 2018 study explores how pricing can be used to manage congestion, promote fairness, and support investment in a region with some of North America’s worst traffic congestion. Analysis showed that cordon pricing would cost the average household \$5-8 per day while reducing congestion by 20-25% and raising \$1.5 billion net per year in revenues. A multi-zone VMT fee would cost the average household \$3-5 per day, reducing traffic congestion by 20-25% and generating up to \$1.6 billion per year. The study suggests the following to ensure that pricing revenues be spent equitably:

- ▶ Reducing the fuel tax and/or other taxes that currently contribute to the transportation system
- ▶ Providing a tax credit to lower income households
- ▶ Reducing transit fares

Source: Mobility Pricing Independent Commission, 2018

Based on extensive input from stakeholders and advisory committees, the CTP 2050 identifies key considerations and guiding principles for roadway pricing over the CTP 2050 30-year planning horizon:

Guiding Principles for Roadway Pricing in California

- ▶ Roadway pricing programs in California—whether at the state, local, or regional level—should prioritize fair and equitable payment by implementing means-based fee structures, exemptions, tax deductions, and/or other mitigations for low- and middle-income Californians and those who do not have any feasible alternatives to driving.
- ▶ Revenues generated from roadway pricing should be invested in alternatives to driving that are safe, convenient, and affordable, including transit and rail options and active transportation, or investments that promote efficient land use patterns, affordable housing, and support other long-term transportation goals outlined in the CTP 2050.
- ▶ The impacts of roadway pricing on freight and delivery vehicles should be considered when developing a roadway pricing program. Increasing the cost of goods movement can increase the cost for consumers, and truck freight carriers typically do not have feasible alternatives.
- ▶ Pricing programs should consider the impacts on rural and Tribal communities throughout the state, who typically travel much farther distances and have limited access to non-auto transportation options.
- ▶ Evaluation of pricing programs that are not mileage-based, such as tolling and cordon pricing, should consider the traffic impacts on nearby roadways and communities

Based on these guiding principles, short-term actions that California can take to set the stage for roadway pricing are shown below. California cities and MPOS are already leading the way in developing roadway pricing programs. Moving forward—coordination, cooperation, and information-sharing will be essential to building a future pricing program that meets statewide goals of advancing social equity, reducing VMT and GHG emissions, and securing sustainable transportation funding sources.

TABLE 12 RECOMMENDATION 10 ACTION ITEMS

Actions	
New	<div>1. Study the impacts of roadway pricing on social equity in various future economic scenarios, including implications for goods movement and in rural parts of the state</div> <div>2. Enact State legislation to allow for roadway pricing programs, grounded in research on equity and other implications</div> <div>3. Evaluate road pricing exemptions for low-income Californians, those unable to operate a vehicle, public transit vehicles, and certain freight vehicles</div> <div>4. Invest in non-auto travel options along corridors subject to roadway pricing to provide people with viable alternatives to driving</div>
Continued	<div>5. Provide guidance and facilitate coordination on roadway pricing (research, best practices, considerations) to support regional and local partners, such as SCAG, MTC, Los Angeles County, and San Francisco who already are investigating pricing programs</div>



11

Encourage Efficient Land Use

Land use directly influences how we travel. More efficient land use can expand mobility options, reduce travel times, and limit emissions, all while addressing California's housing shortage. Improving accessibility involves bringing origins and destinations closer together, such as housing, schools, shopping, parks, and

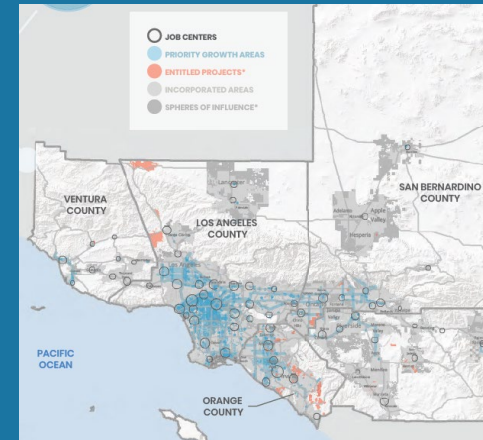
entertainment. This can be achieved in urban, suburban, and rural parts of the state, not only by concentrating future housing and job growth, but also by improving the balance of different land uses. These changes can be supported by infrastructure investments such as complete streets, transit and active transportation infrastructure, and last-mile connections that support compact, mixed-use developments. As discussed in Chapter 2, improving land use efficiency can lead to gentrification as accessible neighborhoods attract higher-income earners and displace low-income residents from their long-time communities. To address this, we must ensure that tenant protections, anti-displacement, and housing affordability measures are in place (see recommendation #4 Advance Social Equity).

TABLE 13 **RECOMMENDATION 11 ACTION ITEMS**

Actions	
New	<ol style="list-style-type: none"> 1. Support local agencies in reducing parking minimum and/or enacting parking maximums and provide support in identifying, funding, and implementing mobility solutions for those impacted by parking loss 2. Provide data and technical tools to help State, regional, and local governments evaluate the transportation impacts of land use decisions 3. Identify and pursue opportunities in repurpose antiquated land uses such as gas stations, parking lots, and large shopping centers to support compact, mixed-use development and sustainable mobility options
Continued	<ol style="list-style-type: none"> 4. Prioritize state transportation funding for projects that support sustainable communities strategies 5. Increase coordination with land use decision-making agencies to identify and prioritize specific transportation investments needed to support compact, mixed-use development 6. Support local agencies in expanding transit-oriented development, ensuring that affordable housing options are available to low- and middle-income Californians and that existing tenants along transit corridors are subject to anti-displacement protections 7. Use existing funding programs, such as greenhouse gas reduction funds (GGRF) and SB1 funds, to elevate projects that support efficient land use and development patterns

LOCAL SPOTLIGHT

The Southern California Association of Governments is planning for a more urban-focused future, in which 68 percent of new households and 79 percent of new jobs occur within priority growth areas.



Source: SCAG, Connect SoCal 2020



12

Expand Protection of Natural Resources and Ecosystems

California has long been a leader in protecting and enhancing our natural resources and ecosystems—a priority which is becoming even more important as we adapt to and mitigate the growing impacts of climate change. As our population continues to grow, and our transportation system evolves to better serve it, we must continue to protect California’s natural lands, waters, wildlife, and habitats—both for their intrinsic value, and for their role in supporting our economy, agriculture, recreation, and quality of life. This recommendation aims to minimize the adverse environmental impacts of the transportation system, while enhancing California’s natural resources and environmental health.

TABLE 14 RECOMMENDATION 12 ACTION ITEMS

Actions	
New	<ol style="list-style-type: none"> 1. Investigate the benefits of establishing statewide priority development and conservation areas to enhance natural ecosystems and encourage preservation of agricultural lands, open space, and critical environmental areas 2. Partner with resource and local agencies to establish mitigation areas and banks
Continued	<ol style="list-style-type: none"> 3. Increase statewide coordination to reduce transportation related pollutants in accordance with National Ambient Air Quality (NAAQ) standards and National Pollutant Discharge Elimination System (NPDES) standards 4. Study and deploy innovative construction practices that minimize the direct environment impacts of transportation projects 5. Prioritize and promote roadside land management activities that are consistent with the California Forest Carbon Plan and the Natural and Working Lands Implementation Plan 6. Expand usage of natural infrastructure solutions such as bioswales, rainwater storage systems, and permeable pavements to enhance infrastructure resiliency 7. Integrate advanced engineering and design methods into transportation projects to improve wildlife crossings and enhance aquatic and terrestrial habitat connectivity 8. Expand collaboration with resource agencies and Tribal nations throughout project development to integrate environmental preservation into all transportation projects 9. Support regional partners in brownfield cleanup and conversion to greenfields and healthfields by modifying existing state right-of-way restrictions on ownership of brownfield sites



13

Strategically Invest in State of Good Repair Improvements

To keep Californians moving safely and efficiently, we must protect and enhance our existing multimodal infrastructure assets, including transit assets, by strategically investing in state of good repair improvements. This recommendation is aligned with the three strategies identified in the TAMP: a “fix it first” approach to asset management; leveraging investments to achieve state and national transportation goals; and sustainable pavement practices that extend the life of the transportation system. The CTP 2050 builds on these strategies by calling for increased focus on maintenance and preservation of bicycle and pedestrian assets at the state, local, and regional

level; and for directing a greater portion of funding for maintenance, operations, and rehabilitation to parts of the state that have historically been underinvested. Providing high-quality infrastructure also means adapting assets to accommodate changing public demand and leveling the playing field across modes after decades of prioritizing auto-oriented infrastructure.

TABLE 15 RECOMMENDATION 13 ACTION ITEMS

Actions	
New	<ol style="list-style-type: none"> 1. Require the addition of multimodal project components, such as Complete Streets upgrades and traffic calming measures, during maintenance and preservation activities, where feasible 2. Align funding for state of good repair and state highway operations projects with VMT-reduction projects such as tolling and express lanes 3. Modernize asset management practices by leveraging new technologies and data
Continued	<ol style="list-style-type: none"> 4. Improve statewide risk and deteriorating modeling and life-cycle costing tools to minimize long-run maintenance costs and more efficiently manage assets 5. Continue the “fix it first” approach to managing multimodal infrastructure assets 6. Continue to implement sustainable pavement practices and explore new technologies and materials to extend the life of the multimodal transportation system 7. Accelerate project completion by eliminating delays throughout the project development and delivery process



14

Seek Sustainable, Long-Term Transportation Funding Mechanisms

Achieving the recommendations and actions outlined in this plan will not be possible without securing sustainable, long-term funding for the transportation system. Traditional revenue sources such as the gas tax will need replacement given the increased use of fuel-efficient vehicles. Our funding will need to be resilient to unexpected disruptions such as COVID-19, which had a profound financial impact, affecting all modes through declining user fees, gas taxes and sales tax revenues. To realize our vision for California's future transportation system, and to respond to today's most pressing needs, we must seek new and innovative transportation funding solutions for all modes.

TABLE 16 **RECOMMENDATION 14 ACTION ITEMS**

Actions	
New	<ol style="list-style-type: none"> 1. Implement a statewide means-based road-user charge program as a replacement for the gas tax, based in the findings of the road-user charge study 2. Coordinate with local and regional transportation agencies to develop and implement sustainable transit and active transportation funding models
Continued	<ol style="list-style-type: none"> 3. Explore using additional GGRF, SB1 funding, and other state funding sources to fund VMT-reduction projects 4. Leverage funding and resources across state agencies to achieve mutual goals 5. Explore a state-level fee on TNC travel by ride-hailing companies. Work with local and regional agencies to coordinate fees and revenues, especially in jurisdictions with existing TNC fees 6. Expand value capture mechanisms such as developer impact fees, joint development, and land value taxation to fund infrastructure projects 7. Explore public-private partnerships as a way to finance transportation infrastructure, operations, and maintenance

IMPLEMENTATION

The CTP 2050 offers a roadmap to achieving its vision, but more work is necessary. Following adoption of this plan, Caltrans will develop an Implementation Element, which identifies the requirements necessary to implement the actions identified in this chapter, including agency responsibilities, implementation steps, and timelines.

Unlike RTPs, the CTP 2050 is a financially unconstrained document, meaning that recommendations are not tied to revenues. The identification of funding sources to implement this plan will be critical to ensuring its implementation. The Implementation Element will consider the financial feasibility of recommendations at a high-level, and take financial resources into account when determining roles and responsibility for Caltrans and partner agencies. The Implementation Element will:

- ▶ **Provide details regarding implementation of new and continuing actions**, specifying the lead agency and other parties responsible for implementation of each action, a timeframe for completion and key milestones, and the resources needed to support implementation.
- ▶ **Identify coordinated actions with other state agencies** to maximize implementation potential.
- ▶ **Create a process for monitoring travel, economic, demographic, and other conditions**, that identifies potential indicators of recovery and long-term structural change that could support refinement of the new and continuing actions.
- ▶ **Provide guidance for integration of the CTP with Caltrans modal plans and regional planning efforts**, highlighting specific CTP goals, objectives, performance measures, and strategies that are relevant to each modal plan.
- ▶ **Provide guidance for integration of the CTP into State transportation policies** related to topics like systems planning, corridor planning, project development, design, project delivery, project prioritization, and programming.
- ▶ **Define strategies for ongoing coordination with partners and engagement with the public during plan implementation**, including a steering committee to coordinate overall implementation activities, as well as working groups for specific actions.
- ▶ **Define strategies for coordination within Caltrans** divisions, offices, and districts, to link the CTP vision and goals to a wide range of agency initiatives.
- ▶ **Develop an ongoing performance monitoring process** that reports progress toward all CTP objectives, including both federally required and state-specific.

The Implementation process will begin upon adoption of the CTP 2050, and will inform the next iteration of the CTP, which is anticipated to conclude in 2025.

THE PATH AHEAD

The scope of the CTP 2050 is broad, but its importance is clear. Our transportation system affects every one of us, every day. Adapting this system to better serve the people of California will directly benefit the health, safety, and resilience of our communities. California's path toward a more safe, sustainable, and accessible transportation system will be difficult, but the benefits will be profound. If implemented, the CTP 2050 will reduce transportation-related GHG emissions, free millions from auto dependency, advance transportation equity, and improve quality of life for Californians. To achieve these benefits, we must address many critical challenges facing our state: economic recovery, resilience to future disruptions, addressing the housing shortage and growing inequality, preparing for a rapidly changing climate, and navigating the uncertain effects of new and emerging technologies.

Our success will depend on the effective management of existing and future resources, research and development that leverages scientific advancements and new technologies, visionary state policies that evolve our regulatory and legal environment to accommodate change, and continued collaboration across regional and jurisdictional boundaries to ensure no community is left behind. Together, California is uniquely positioned to build this brighter future.

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