CHAPTER 9 What's Next?

The Santa Cruz County Regional Transportation Plan is updated approximately every four years to reflect new initiatives, priorities and requirements. It builds upon the work of previous initiatives, complements ongoing work, and lays the groundwork for the future. This chapter identifies several considerations that will likely be discussed in more detail in future editions of the RTP.

Climate Adaptation and Resilience

Santa Cruz County is susceptible to a wide range of climate change effects including increased temperatures, changing precipitation patterns, increased number and severity of wildfires, sea-level rise, extreme weather events, and numerous effects on biodiversity and habitats. The transportation sector has been identified as a major contributor of climate impacting greenhouse gas emissions, and in return the transportation system is impacted by increased flooding, landslides or mudslides, sea level rise, coastal and other erosion, and more frequent and intense heat waves or fires that cause roadways to buckle. Communities and people across our region will have to adjust how they respond to the impacts of climate change today and become more resilient as they face future impacts.

Damage to the Santa Cruz Branch Rail Line because of flooding during 2017 storms

Storms. The Central Coast Region Report in California's Fourth Climate Change Assessment projects that the variability in precipitation will increase substantially with extremely wet and dry years becoming more extreme, with the wettest day of the year expected to increase up to 35%. For example, the winter of 2016-2017 saw over 94 inches in the Santa Cruz Mountains, almost double the historical average. The mudslides, washouts, and other destruction caused by the record rainfall caused an estimated $130 million in damage to Santa Cruz County roadways and bridges, increasing the backlog of roadway maintenance by over 200 new damage sites. The historic rain and flooding also resulted in 2 washouts, embankment failures, fallen trees, landslides, and other damage along the Santa Cruz Branch Rail Line at seven sites, with a total estimated repair cost of $4.5 million.

Sea-Level Rise. Sea-level rise threatens coastal communities, natural resources, cultural sites, and infrastructure. This is a particularly critical climate stressor that impacts Santa Cruz County and includes more extensive coastal flooding during storms, periodic tidal flooding and increased coastal erosion. Current research suggests that coastal California is expected to experience between 1.1 – 1.9 feet of sea level rise by 2050 (with a low-probability, but high impact extreme of 2.7 feet) and between 2.4 – 6.9 feet by 2100 (with a low-probability, but high impact extreme of 10.2 feet).[1] Santa Cruz County's coastal cliffs are experiencing average erosion rates of 0.17 to 2.1 feet or more per year.[2]

Inundation of East Cliff Drive at Twin Lakes State Beach in Santa Cruz during elevated sea levels, high tides and storm waves in February 1998 (Photo: David Revell).

Wildfires. California is experiencing increased frequency of extreme fires and average area burned and many wildfires are burning hotter and more intensely than observed in recent history. The 2020 wildfires resulted in the largest wildfire season recorded in California's modern history**.** In August 2020, a rare powerful lightning storm produced 11,000 bolts of lightning and started hundreds of fires in California, including a cluster of fires in the Santa Cruz Mountains that would merge to become the CZU Lightning Complex Fire. Over 40,000 acres burned in Santa Cruz County, destroying 1,490 structures, and causing $15 million in damage to county transportation infrastructure including destroyed guardrails, damaged drainage, and compromised embankments.

CZU Lightning Complex Fire
Photo Credit: Alekz Londos, Good Times Santa Cruz

Climate factors will affect decisions in every phase of the transportation management process: from long-range planning and investment; through project design and construction; to management and operations of the infrastructure; and system evaluation. To advance Santa Cruz County's climate adaptation and resilience efforts, SCCRTC will work with local jurisdictions to advance regional projects that increase climate change resiliency, and analyze vulnerabilities of the transportation system, including which areas are prone to damage from storms and what is needed to keep critical infrastructure available during an emergency. The California Transportation Commission's (CTC) 2017 RTP guidelines for Regional Transportation Planning Agencies (RTPAs) require that the RTP be consistent with California's Climate

Adaptation Strategy Report. This report outlines the state's key climate resilience priorities, includes specific and measurable steps, and serves as a framework for action across sectors and regions in California.[3]

The Santa Cruz County Regional Transportation Commission, in coordination with Caltrans and local jurisdictions, will need to consider the following to plan for impacts of climate change:

- Facilitate coordinated response from transportation providers to disruptions resulting from climate variability and extreme weather events;
- Develop transportation planning specifications in conjunction with accepted statewide practices concerning new construction and development, such as drainage capacity, location near shore lines, and materials;
- Identify transportation assets at high risk to impacts from climate change;
- For assets at risk, decide upon whether protection will be built around the facility, the facility will be redesigned to accommodate climate change impacts, or the facility will be abandoned and relocated elsewhere.
- Prioritize investments that protect evacuation routes; and,
- Provide guidance for more resilient building materials and design standards for transportation facilities.

The uncertainties inherent in projecting long-term impacts of climate changes coupled with the long service life of most transportation infrastructure present a challenge for transportation decision making. The economic cost associated with climate change impacts has yet to be fully estimated. Impending climate impacts have implications not only for the siting of new transportation infrastructure, but also maintenance and operation, design features of transportation systems, and emergency planning and response for extreme climate events. Because today's transportation network will likely be in place for decades to come, investment and design decisions made today need to consider potential changes in climate conditions 30, 50, and sometimes 100 years or more from now (Figure 9.1).

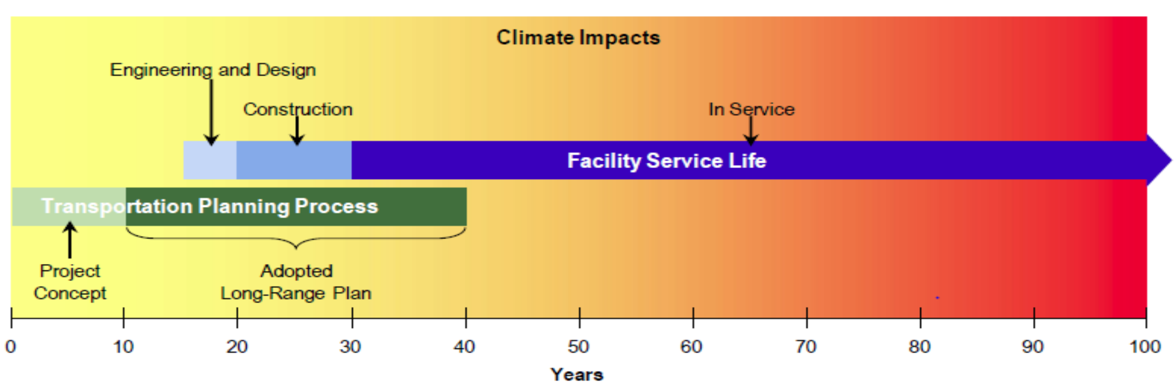

Figure 9.1 – Relationship of Transportation Planning Timeframe and Infrastructure Service Life to Increasing Climate Change Impacts

Source: Climate Change Science Program and the Subcommittee on Global Change Research[4]

In 2019, Caltrans completed a Climate Change Vulnerability Assessment for District 5 that identifies sections of the highway system at greatest risk to extreme weather events related to climate change throughout the Central Coast[5]. Caltrans District 5 also prepared an Adaptation Priorities Report (2021), which evaluates at-risk assets and prioritizes exposed assets while exploring facility-level adaptation solutions.[6] The prioritization in Adaptation Priorities Report considers the timing of climate impacts, severity and extent, condition of each asset (a measure of the sensitivity of the asset to damage), the number of system users affected, and the level of network redundancy in the area. The plan identifies seven bridges, one large culvert at Salsipuedes Creek in Watsonville, and one small culvert and roadway segment along northern Highway 1 as the highest priorities for detailed climate change adaptation assessments in Santa Cruz County. The RTC will continue to monitor federal and state activities for addressing climate adaptation as well as the actions of local entities which have instituted policies and plans for addressing climate adaptation.

Autonomous Vehicles

The effects of autonomous vehicles on future transportation systems are under much debate. Autonomous vehicles (AVs) are an emerging technology that could bring a number of benefits to the transportation system including increased safety through a reduction of injuries and fatalities, increased throughput and mobility within existing capacity due to driving efficiencies, environmental benefits from smarter driving that releases fewer emissions, and improved system management through vehicle data. Conversely, there is also the potential of AVs to drastically increase traffic congestion and the amount of vehicle miles traveled particularly when self-driving vehicles no longer require a person on board. These potential benefits and challenges have not been integrated into the 2045 RTP for a number of reasons. There are many uncertainties associated with AVs including a currently unfolding set of federal and state regulations, resolution of questions around programming ethics, solutions to liability and insurance concerns, the impacts of AVs on transportation infrastructure needs, and market adoption rates.

The large Metropolitan Planning Organizations in California like San Diego Association of Governments (SANDAG) and Southern California Association of Governments (SCAG) are just beginning to incorporate autonomous vehicles into their regional transportation plans. The RTC will be following these efforts to determine how best to incorporate autonomous vehicle technology in transportation planning. The RTC updates the RTP every four years and will have numerous opportunities before AVs become common to consider appropriate policy and infrastructure investments.

Definitions

Generally, an AV is defined by the ability of the vehicle to control a safety-critical function such as steering, throttle, or braking without direct driver input.[7] AVs may be truly autonomous (using only vehicle sensors) or may be connected (using communication systems such as vehicle-to-vehicle and vehicle-to-infrastructure technologies in addition to sensors). Connectivity is a critical feature to realizing the full potential benefits of AVs. AV technology is advancing at a rapid rate and not all AVs automate every vehicle function. Therefore, it is helpful to define various levels of automation.

The National Highway Traffic Safety Administration has adopted the Society of Automotive Engineers (SAE) definitions for automation which include five levels. Levels one through two include vehicles where some functions are automated such as assisted parking or adaptive cruise control, but still require a human driver to conduct some or most parts of the driving tasks. Level one and two vehicles are already common and available for purchase. Levels three to five are considered highly autonomous vehicles and are defined by the ability of the vehicle to conduct most or all of the driving tasks.[8]

Implementation and Timeline

There are a number of factors that could influence the adoption rate of autonomous vehicles. Currently the cost of the technology is prohibitively expensive and some have argued that the legal issues regarding privacy and liability will delay implementation even if the costs were not so high. As demand grows and economies of scale are realized the costs will slowly go down, but some research concludes that even with "robotaxi" automated ride-hailing options, costs will still be higher than the average cost of vehicle ownership now.[9] Regarding the legal and liability concerns, states have already started passing legislation that allows for testing and use of AVs on existing roadways. The legal framework around current vehicle systems is multifaceted and did not develop overnight but was rolled out as vehicles became more commonplace and attempts at regulating failed and then succeeded. Similarly, the legal framework for regulating AVs will slowly evolve over time and will, as most law does, look to the past as a starting point.[10] Until then manufacturers of AVs will have to develop vehicles that comply with existing law and at least initially AVs will operated in mixed traffic.

There are also factors that may increase the speed of market adoption including a large amount of investor interest in rapidly evolving vehicle-to-vehicle and vehicle-to-infrastructure technology. The automotive industry's introduction of a subscription based model of vehicle usage versus the traditional ownership models may also influence autonomous vehicle fleet mix by providing easier access to AVs thereby facilitating consumer acceptance.[11, 12] Additionally, companies that retrofit older vehicles with autonomous features may increase the vehicle fleet more rapidly.[13]

The ability to program the AVs to make difficult decisions in the context of more complex roadways such as local roads is another area of uncertainty. On highways and expressways AVs have limited types of encounters, usually only maneuvering other vehicles or lanes and there is little variation in the right-of-way. On local roads, there are intersections, driveways, potholes, debris, animals, as well as people walking or riding a bike. The number of complex decision points on local roads soars due to more variation in the right-of-way and increased encounters with unpredictable objects. Programming for all these decision points can require consideration of some complicated ethical questions, making it more likely that lower level AVs requiring human interference and control for these types of driving environments will be introduced into the market first.

Based on an entry date of 2025, historic vehicle purchasing and turn-over rates, as well as the factors presented above, the Victoria Transport Policy Institute (VTPI) forecasts that market saturation would not occur until the 2070's and that full self-driving vehicles (SAE Level 5) would not be commercially available until the 2030's or 2040's.[14]

Infrastructure and Planning

The presence of AVs has the potential to transform the way planners manage traffic and will require a number of significant investments in intelligent transportation system (ITS) architecture over the long term. In the short-term AVs will have minimal impacts on infrastructure requirements since they can operate in mixed traffic on existing roadways shared with conventional vehicles.

Vehicle-to-infrastructure technology would allow for public agencies to provide drivers with warnings based on information regarding known and predictable conditions such as signal phasing and timing (SPaT), work zones, transit signal priority, emergency vehicle preemption and sharp curves.[15]

Autonomous vehicles have the potential to increase driving efficiency and therefore throughput or capacity as measured in vehicles per hour per lane (vphpl). However, until AVs constitute a large majority of the vehicle fleet, their roadway operational benefits to locations with recurring congestion may not be realized if they are mixed with traditional vehicles. To realize increased vphpl designated lanes or separate roadway facilities may be needed. However, increased roadway capacity in the form of additional designated lanes is costly and may be infeasible in locations where land and resources are limited. Additionally, as discussed above initially AVs may still need human interaction on more complex local roadways reducing their ability to increase driving efficiency on roadways other than highways.

Despite differences of opinions around timing and implementation much research now agrees that the introduction of AVs will increase vehicle miles traveled.[16,17] Fully autonomous vehicles will increase vehicle use by people who could previously not drive and may cause an increase in the number of trips people make and thus the number of miles people travel if vehicles can be programmed to do errands without the need for people to be in the vehicle. Reductions in congestion due to driving efficiencies could be eliminated by increases in congestion due to increasing VMT. Increasing AV use will require the RTC and other public agencies to rethink investment strategies and policy decisions in order to determine how the triple bottom line of sustainability may be impacted.

State and Federal Policy

The responsibilities for the regulation of human driven vehicles are clearly delineated between the federal Department of Transportation's National Highway Traffic Safety Administration (NHTSA) and the states. Currently the federal responsibilities for motor vehicles include setting and enforcing Federal Motor Vehicle Safety Standards (FMVSS), investigating and managing recalls and remedies for non-compliance, communicating and educating the public about safety issues, and issuing guidance for manufacturers to follow. State responsibilities include licensing drivers and registering vehicles, enacting and enforcing traffic laws and regulations, conducting safety inspections if they chose to do so, and regulating vehicle insurance and liability. With the introduction of AVs there may be new responsibilities that do not clearly fall within the existing parameters.

NHTSA released a policy document containing performance guidelines for highly autonomous vehicles (HAVs) in September 2016 with the acknowledgement that it is preliminary guidance intended to lay the foundation for future federal policy.[18] While the guidance is not currently mandatory, manufacturers designing HAVs are subject to NHTSA's defect, recall and enforcement authority. Some elements of the guidance may become mandatory in the near future and there will be additional augmentations to the guidance as NHTSA conducts more research. The NHTSA recommends maintaining a similar clear line of responsibilities with AVs as is currently provided for human driven vehicles. The policy document also provides a model state policy with the goal of encouraging consistency amongst states in their approach to regulating AVs. After the release of this policy document the United States Congress began considering legislation that would bar states from blocking AVs.

California currently allows for AV testing but requires licensing with the state and regular reporting on any system problems or incidents. As of August 2021, 53 different firms have permits to test AVs with a driver in California, 8 firms have permits to test without a driver, and one company, Nuro Inc. has a permit to deploy autonomous vehicles.[19] The California Department of Motor Vehicles approved regulations establishing a path for post-testing deployment of full AVs, which was adopted February 26, 2018.

Notes for Chapter 9

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13 Companies such as Autonomous Stuff and Drive.ai are already exploring and developing ways to retrofit vehicles to add autonomous features.

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