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 a number of considerations that will likely be discussed in more detail in future editions of the RTP.

Climate Adaptation

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 system is impacted by increased flooding, landslides or mudslides, erosion, and heat waves or fires that cause roadways to buckle. The mudslides caused by the high levels of rainfall in winter of 2016-17 caused significant damage to Santa Cruz County roadways increasing the backlog of roadway maintenance substantially. Sea-level rise 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 could experience a 5 to 10 inch rise in sea level by 2040 based on annual sea level rise rate of about 4– 8 mm/yr.[1] Santa Cruz County's coastal cliffs are experiencing average erosion rates of 0.17 to 2.1 feet or more per year.[2]

The Santa Cruz County Regional Transportation Commission is aware of the need to undertake efforts that respond to impacts of climate change. The state of California regularly updates California's Climate Adaptation Strategy.[3] This report outlines the high level recommendations for all sectors as well as the strategies that are needed to combat the affects of climate change and the projects and programs already being implemented. The California Transportation Commission's (CTC) 2017 RTP guidelines for Regional Transportation Planning Agencies (RTPAs) require RTPs to be consistent with California's Climate Adaptation Strategy Report. 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.

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**). The RTC will 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.

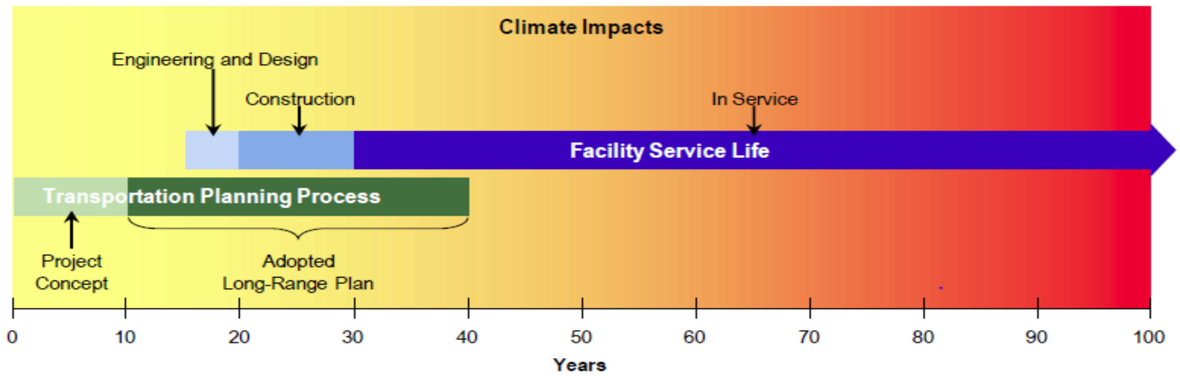

Figure 9.1 – Relationship of Transportation Planning Timeframe and Infrastructure Service Life to Increasing Climate Change Impacts

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

Automated Vehicles

The effects of automated vehicles on future transportation systems are under much debate. Automated 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 2040 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 automated vehicles into their regional transportation plans. The RTC will be following these efforts to determine how best to incorporate automated 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. A more detailed explanation of automated vehicles and the issues related to transportation planning is provided in the following paragraphs.

Definitions

Generally speaking 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.[5] AVs may be 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 automated vehicles and are defined by the ability of the vehicle to conduct most or all of the driving tasks.[6]

Implementation and Timeline

There are a number of factors that could influence the adoption rate of automated 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 then costs will still be higher than the average cost of vehicle ownership now.[7] 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.[8] 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 automated vehicle fleet mix by providing easier access to AVs thereby facilitating consumer acceptance.[9, 10] Additionally, companies that retrofit older vehicles with automated features may increase the vehicle fleet more rapidly.[11]

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 2020, historic vehicle purchasing and turn-over rates, as well as a the factors presented above, the Victoria Transport Policy Institute (VTPI) forecasts that market saturation would not occur until the 2060's and that full self-driving vehicles (SAE Level 5) would not be commercially available until the 2030's or 2040's.[12]

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.[13]

Automated 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.[14,15] Fully automated 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 automated vehicles (HAVs) in September 2016 with the acknowledgement that it is preliminary guidance intended to lay the foundation for future federal policy.[16] 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 March 2017, 22 different firms have registered to test AVs in California.[17] The California Department of Motor Vehicles has also released draft regulations establishing a path for post-testing deployment of full AVs, which at the time of this research had not been adopted.

Notes for Chapter 9

[1] Griggs, G, Árvai, J, Cayan, D, DeConto, R, Fox, J, Fricker, HA, Kopp, RE, Tebaldi, C, Whiteman, EA (California Ocean Protection Council Science Advisory Team Working Group), "Rising Seas in California: An Update on Sea-Level Rise Science," California Ocean Science Trust, April 2017.

[2] Matthew Heberger, Heather Cooley, Pablo Herrera, Peter H. Gleick, and Eli Moore of the Pacific Institute, "The Impacts of Sea Level Rise on the California Coast," California Climate Change Center, May 2009.

[3] "California's Climate Adaptation Strategy; Safeguarding California Plan – 2017 Update", accessed October 2017, http://resources.ca.gov/climate/safeguarding/

[4] U.S. Climate Change Science Program and the Subcommittee on Global Change Research, "Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I," U.S. Department of Transportation, Washington, D.C. (2008), http://climate.dot.gov/documents /gulf_coast_study.pdf.

[5] United States Department of Transportation, "Automated Vehicle Research," Office of the Assistant Secretary for Research and Technology, Intelligent Transportation Systems Joint Program Office, accessed August 2017, https://www.its.dot.gov/automated_vehicle/

[6] National Highway Traffic Safety Administration (NHTSA), "Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety," United States Department of Transportation (September 2016).

[7] Todd Litman, "Autonomous Vehicle Implementation Predictions: Implications for Transport Planning," Victoria Transport Policy Institute (July 18, 2017).

[8] Dorothy J. Glancy, Robert W. Peterson, and Kyle F. Graham, "A Look at the Legal Environment for Driverless Vehicles," Transportation Research Board National Cooperative Highway Research Program: Legal Research Digest 69 (February 2016).

[9] Brian Fung, "Subscription-based car model gains traction in cities," Chicago Tribune (March 22, 2017), accessed August 2017, http://www.chicagotribune.com/classified/automotive/sc-car-ownership-alternatives-autotips-0323-20170321-story.html

[10] Cadillac and General Motors are already piloting subscription programs in urban areas.

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

[12] Todd Litman, ibid.

[13] Federal Highway Administration, "Connected Vehicle Impacts on Transportation Planning Desk Reference," (June 2016).

[14] Fehr and Peers, " Effect of Next-Generation Vehicles on Travel Demand and Highway Capacity," (February 2014). And Cite both FP and Symposium

[15] Transportation Research Board, "Automated Vehicles Symposium 2016," Transportation Research Circular: Number E-C22 (July 2017).

[16] NHTSA, ibid.

[17] "Adopting and Adapting: State and Automated Vehicle Policy," Paul Lewis, Gregory Rogers and Stanford Turner, Eno Center for Transportation (June 2017).