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16. ABSTRACT

Over the last decade in California there has been a surge in the number of traffic fatalities, with especially large increases in pedestrian fatalities. At the same time, the California Department of Transportation (Caltrans) has affirmed a vision of reaching zero fatalities and serious injuries on state highways by 2050 and has committed the department to reaching this goal by adopting the Safe System Approach. The Safe System Approach is underpinned by the principles that humans make mistakes and that the transportation system should be designed to account for the human body's ability to tolerate crash impacts. Because speed increases both the likelihood of being involved in a crash and the severity of injuries sustained in a crash, speed management is critical to designing a Safe System for all road users. In contrast to a Safe System Approach, in which speed limits are set in a manner that minimizes the risk of serious injury or death, the current approach to speed-limit setting in California is based on driver behavior (using the 85th percentile rule). This report builds off research and case studies within and outside of the United States to provide a framework for the State of California to develop a new roadway-based, context-sensitive approach to establishing speed limits that prioritizes the safety of all road users.

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Developing A Safe System Approach to Setting Speed Limits

FINAL REPORT

Task Order 65A0808

by

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Executive Summary

Over the last decade in California there has been a surge in the number of traffic fatalities (up 45.7% between 2012 and 2021), with especially large increases in pedestrian fatalities (up 70% between 2012 and 2021) (NHTSA, FARS data). At the same time, the California Department of Transportation (Caltrans) has affirmed a vision of reaching zero fatalities and serious injuries on state highways by 2050 and has committed the department to reaching this goal by adopting the Safe System Approach.

The Safe System Approach is underpinned by the principles that humans make mistakes and that the transportation system should be designed to account for the human body's ability to tolerate crash impacts. Because speed increases both the likelihood of being involved in a crash and the severity of injuries sustained in a crash, speed management is critical to designing a Safe System for all road users.

In contrast to a Safe System Approach, in which speed limits are set in a manner that minimizes the risk of serious injury or death, the current approach to speed-limit setting in California is based on driver behavior (using the 85th percentile rule). This existing approach has been recognized by researchers, government bodies, and practitioners as misaligned with safety objectives, especially in urban areas with complex, mixed-use environments and high densities of pedestrians and bicyclists.

This report builds off research and case studies within and outside of the United States to provide a framework for the State of California to develop a new roadway-based, context-sensitive approach to establishing speed limits that prioritizes the safety of all road users.

The new and comprehensive framework being proposed in this report is a strong match with the Safe System Approach to speed-limit setting and will improve safe mobility in California if implemented. The model is primarily drawn from New Zealand's speed-limit setting approach, which is designed to set speed limits that center safety and are in line with community objectives, the intended uses, and the roadway design. New Zealand accomplishes these goals by defining street categories based on a *Movement and Place* principle for each segment of their road network in order to highlight the need for a road to move both people and goods while also serving as a destination for people. How a given road segment is defined by movement and place, and whether it is an urban or rural road, then correspond to both a baseline and range of safe and appropriate speed limits to be implemented.

California is well-positioned to apply a similar approach, as our functional classification for roadways is already an excellent metric of "movement." While no single existing metric closely aligns with "place," this report explores various straightforward options for California to generate a "place" metric with spatial granularity at a blockgroup level that could accurately capture a nuanced picture of land uses adjacent to road environments across the state.

While the proposed shift to a context-sensitive approach to speed-limit setting in California will likely face legislative and implementation challenges, by leveraging successful models from around the world and tailoring them to California's unique context, we can shift toward a Safe System Approach to speed-limit setting, establish safe and appropriate speed limits, and prioritize the well-being of all road users.

The implementation of this new approach will require collaborative efforts from policymakers, transportation agencies, and the community to make our roads safer and fulfill our ethical imperative to prevent serious injuries and save lives.

Acronyms used in this Report

AB: Assembly Bill

AVMT: Annual Vehicle Miles Traveled

CA: California

CalSTA: California State Transportation Agency

Caltrans: California Department of Transportation

CRS: California Road System

CVC: California Vehicle Code

E&TS: Engineering and Traffic Survey

EPA: Environmental Protection Agency

FARS: Fatality Analysis Reporting System

FHWA: Federal Highway Administration

GIS: Geographic Information System

IRR: Infrastructure Risk Rating

ISA: Intelligent Speed Adaptation

mph: miles per hour

MPO: Metropolitan Planning Organization

MUTCD: Manual on Uniform Traffic Control Devices

NACTO: National Association of City Transportation Officials

NHTSA: National Highway Traffic Safety Administration

ONF: One Network Framework

SAAS: Safe and Appropriate Speed

SafeTREC: Safe Transportation Research and Education Center

SLS: Speed Limit Setting

SMF: Smart Mobility Framework

SSC: Speed Safety Camera

U.S.: United States

ZTFTF: Zero Traffic Fatalities Task Force

Chapter 1 - Introduction

The Safe System Approach to traffic safety is one that aims to eliminate fatal and serious injuries for all road users and is based on the principles that humans make mistakes and that the transportation system should be designed to account for the human body's ability to tolerate crash impacts (Federal Highway Administration n.d.). Ultimately, the Safe System Approach is grounded in an ethical imperative which centers on the idea that no one should be killed or severely injured when using the roadway system.

In February 2022, the Director of Caltrans released DP-36 (Director's Policy on Road Safety), committing the department to the Safe System Approach and reaffirming the vision of reaching zero fatalities and serious injuries on state highways by 2050 ("DP-36: Caltrans Director's Policy on Road Safety" 2022).

One of the five key elements of the Safe System Approach is Safe Speeds. Safe Speeds are critical for safety because speed both increases the likelihood of being involved in a crash (by reducing the time available for drivers to stop and shrinking the driver's visual field) and significantly increases the severity of injuries sustained by all road users in a crash because of greater impact forces (Grembek et al. 2020).

Higher speeds increase fatalities, and the ability to achieve Safe Speeds requires the implementation of multiple, complementary approaches to speed management, including engineering changes to roadway design, vehicle technologies like intelligent speed adaptation, safe and appropriate speed limits, effective and equitable enforcement strategies, and increased awareness of the risks of high speeds. While pursuing each of these countermeasures in concert can improve speed management efforts, lowering speed limits to a safe and appropriate speed limit can decrease mean speed and reduce the speed of the fastest drivers independent of other speed management approaches, as shown in the Research Synthesis for the AB 2363 Zero Traffic Fatalities Task Force (Grembek et al. 2020).

It is important to note that, while a safe and appropriate speed limit will not always mean a lower speed limit, in most cases a safe and appropriate speed limit will be lower than the current posted limit because California's current speed-limit setting (SLS) approaches are ultimately based on driver behavior, not on the human body's ability to tolerate crash impacts. Notably, however, there are some cases in which a higher speed limit may be appropriate provided that adequate Safe System infrastructure has been implemented to help prevent fatal and severe injuries for all road users.

The Zero Traffic Fatalities Task Force (ZTFTF) convened by CalSTA pursuant to AB 2363 released a Report of Findings in January 2020 that identified key findings and made specific recommendations to eliminate traffic fatalities in California (AB 2363 Zero Traffic Fatalities Task Force 2020). The ZTFTF Report exposed the limitations of California's current SLS methodology, which is based on driver behavior (through measurement of the 85th percentile driver speed). Accordingly, a significant number of the recommendations made by the ZTFTF relate to SLS approaches and policies in California.

The ZTFTF Report recommended several short-term approaches to improving current SLS practices, such as allowing for lower *prima facie* speed limits in "business districts" and allowing traffic survey procedures to specifically consider safety and the presence of bicyclists and pedestrians (AB 2363 Zero

Traffic Fatalities Task Force 2020). The legislature has acted quickly on these short-term recommendations by passing AB 43 in 2021 and AB 1938 in 2022 that grant local jurisdictions greater flexibility in setting speed limits ("Bill Text - AB-43 Traffic Safety." 2021; "Bill Text - AB-1938 Traffic Safety: Speed Limits." 2022).

These short-term recommendations and recent corresponding changes to SLS practices in California have been strong and welcome interim steps in the direction of elevating safety. However, the ZTFTF Report also made a specific long-term recommendation for SLS based on the finding that any SLS methodology that starts with driver behavior (i.e., any percentile-based approach) represents an outdated method that no longer meets the safety needs of California's multimodal, complex transportation environment. Accordingly, the ZTFTF put forward recommendation C-S1, to: "Develop and implement a new roadway-based context sensitive approach to establish speed limits that prioritizes the safety of all road users" (AB 2363 Zero Traffic Fatalities Task Force 2020).

Recommendation C-S1 ultimately centers the Safe System Approach and explicitly urges California to move away from any approach that sets speed limits using driver behavior and toward an approach that prioritizes the safety of all road users. In this report, we provide a framework for a new roadway-based, context-sensitive approach to establishing speed limits for the State of California.

Chapter 2 - Speed Limit Setting in a Safe System Approach

Overview of Current Speed-Limit Setting Guidance and Regulations

When setting speed limits on roadways without *prima facie* limits, both the California Department of Transportation (Caltrans) and local agencies must follow specific SLS procedures established in the California Manual on Uniform Traffic Control Devices (CA MUTCD), which is an interpretation of the California Vehicle Code § 627. The California Manual for Setting Speed Limits, issued by Caltrans, is a user manual that summarizes these SLS procedures (Division of Traffic Operations 2020).

With the exception of certain *prima facie* road types and zones that have default speed limits, posted speed limits are normally set near the 85th percentile of driver speed. As stated in the 2020 California Manual for Setting Speed Limits, "speed limit determinations rely on the premise that a reasonable speed limit is one that conforms to the actual behavior of the majority of drivers; one will be able to select a speed limit that is both reasonable and effective by measuring drivers' speeds" (Division of Traffic Operations 2020). This statement is inconsistent with the findings of the Research Synthesis for the AB 2363 ZTFTF that drivers tend to underestimate speed and have limited capability to self-regulate a safe speed (AB 2363 Zero Traffic Fatalities Task Force 2020).

Further, as noted in the ZTFTF report, another unintended consequence of basing speed limits on the behavior of drivers is "speed creep," or rising vehicle operating speeds over time, in which faster driver speeds require increases to speed limits and then higher speed limits prompt motorists to drive faster, again prompting a further increase to speed limits (AB 2363 Zero Traffic Fatalities Task Force 2020).

The Safe System Approach and Safe Speeds

Instead of relying on driver behavior, shifting to SLS using a Safe System Approach puts protecting people as the central objective and has been shown to promote the safety of all road users. A Safe System Approach to traffic safety is one that aims to eliminate fatal and serious injuries for all road users and is based on the principles that humans make mistakes and that the transportation system should be designed to account for the human body's ability to tolerate crash impacts (see Table 1) (Federal Highway Administration n.d.).

Table 1: Traditional vs Safe System Approach (Towards Zero Foundation, 2021)

	TRADITIONAL	SAFE SYSTEM
What is the problem?	Accidents	Fatalities and serious Injuries
What causes the problem?	Human factors	People makes mistakes, people are fragile
Who is ultimately responsible?	Individual road users	System designers
What is the major planning approach?	Incremental approach to reduce the problem	Systematic approach to build a safe road system
What is the appropriate goal?	Optimum number of fatalities and serious injuries	Zero fatalities and serious injuries

As shown in Figure 1, six principles form the basis of the Safe System approach: (1) deaths and injuries are unacceptable, (2) humans make mistakes, (3) humans are vulnerable, (4) responsibility is shared, (5) safety is proactive, and (6) redundancy is crucial. These principles are not specific to any roadway element but integrated throughout roadway design, operation, and users. The Safe System Approach is then composed of five elements to achieve the principles: Safe Speeds, Safe Roads, Safe Vehicles, Safe People, and Post-Crash Care.

Figure 1: The Safe System Approach (Federal Highway Safety Administration, 2022)

Safe Speeds are central to creating a Safe System because speed both increases the likelihood of being involved in a crash and significantly increases the severity of injuries sustained by all road users in a crash. Accordingly, even small changes in vehicle operating speeds can have important safety impacts.

There exist numerous and complementary approaches to meeting the Safe Speeds objective. These include engineering changes to roadway design, vehicle technologies like intelligent speed adaptation, lower speed limits, effective and equitable enforcement strategies, and increased awareness of the risks of high speeds.

Because redundancy is crucial within a Safe System, each of these elements could be pursued in concert to optimally achieve Safe Speeds. However, as noted by the Federal Highway Administration, "speed limits and operating speeds are connected"(Kumfer et al. 2023), and a review of the literature in the Research Synthesis for the AB 2363 ZTFTF indicates that decreasing speed limits independently of other approaches not only decreases mean speed, but also reduces the speed of the fastest drivers (Grembek et al. 2020). Reducing speed limits also can allow for other important changes that encourage Safe Speeds, as lowered speed limits can often permit engineers to implement roadway design tools that can increase safety (e.g., raised crossings, bulb outs) that are not in their toolbox on streets with higher posted speed limits (NACTO 2020).

Not only do lowered speed limits reduce speeds, but research also supports that lowered speed limits improve safety across most road environments, with fatalities almost always decreasing with only modest (5 mph) decreases in posted speed limits (Grembek et al. 2020). These observed safety effects are small but meaningful, especially in mixed-mode environments with higher concentrations of pedestrians, bicyclists and other vulnerable road users.

Consistent with the ZTFTF recommendation to "develop and implement a new roadway-based context sensitive approach to establish speed limits that prioritizes the safety of all road users" (AB 2363 Zero Traffic Fatalities Task Force 2020), reforming California's SLS methodology is necessary in order for the state to meet its Safe Speeds objective.

Under a Safe System (where deaths and injuries are unacceptable, humans are vulnerable and safety is proactive), speed limits would be designed around the human body's tolerance to impact. While modern vehicle design has led to increased safety at higher speeds for vehicle occupants (by absorbing the crash impact), pedestrians and other road users outside of vehicles are left unprotected, making Safe Speeds essential in areas where pedestrians and other vulnerable road users are present. Unfortunately, at present, there are significant legal, cultural, and institutional barriers to lowering speed limits which will ultimately impede our ability to achieve a Safe System in California.

Barriers to Safe Speed-Limit Setting in California

Within California, three critical barriers have been identified to the development of Safe Speed Limits: 1) cost prohibitive design or study requirements, 2) limited local authority, and 3) institutional resistance.

Cost Prohibitive Design or Study Requirements

The National Association of City Transportation Officials (NACTO) has highlighted the barrier posed by the strict engineering assessments or physical design requirements in place for many local jurisdictions

to justify any lowering of speed limits below the 85th percentile speed (NACTO 2020). This presents a major cost prohibitive requirement for local jurisdictions and can be a major barrier impeding any change to speed limits to promote safety. At a minimum, most states require that local jurisdictions conduct an engineering and traffic survey (E&TS) before speeds can be lowered for any reason and that these surveys be renewed regularly to be enforceable. Maintaining current and up-to-date E&TS's can cost significant staff time.

In California, SLS guidance and standards are specified in the CA MUTCD (California State Transportation Agency 2023) and the California Manual for Setting Speed Limits (Division of Traffic Operations 2020). The CA MUTCD is a modified version of the Federal Highway Administration's Manual on Uniform Traffic Control Devices (Federal Highway Administration 2022); however, ultimate legal authority over speed is determined at the state level, stemming from the California Vehicle Code (CVC). The CVC does allow local jurisdictions to set *prima facie* speed limits on any street other than a state highway, but this may require an E&TS in accordance with the CA MUTCD to justify the change. The MUTCD then requires the use of the 85th percentile to set the speed, thus the reliance on the 85th percentile is collaterally enforced in the MUTCD by the CVC. In California, E&TS's remain valid for seven years (for purposes of speed enforcement) or for 14 years if evaluated by a registered engineer. In California, the lowest *prima facie* speed is 25 mph (with the exception of some special zones such as near schools, in alleys or at railroad crossings, where it can be set as low as 15 mph). Recent legislation (AB 43) allows local jurisdictions to set *prima facie* speed limits as low as 20 mph in business districts, so long as these roadways are not state highways ("Bill Text - AB-43 Traffic Safety." 2021).

Limited Local Authority

NACTO has also highlighted that many local jurisdictions have limited local authority to lower posted speed limits, and nationally, only five states (Oregon, Washington, Minnesota, New York, and Massachusetts) currently allow local jurisdictions to set their own speed limits. Despite these flexibilities, even among these states, most include legal provisions that impose some constraints; for example, local jurisdictions in Oregon can only lower speeds to 20 mph using the 50th percentile speed and only do so on non-arterials, and New York's local authority only applies to New York City (NACTO 2020).

In California, while local jurisdictions have relatively limited authority to independently set speed limits, two recently passed state bills do provide some expanded local authority. Passed in 2021 and 2022 respectively, AB 43 and AB 1938 grant local jurisdictions authority to lower speed limits by an additional five miles per hour below the 85th percentile speed using two criteria: 1) the roadway has been identified as a "safety corridor" because of high numbers of fatal or severe injury crashes, or 2) the roadway is adjacent to areas generating high pedestrian and bicyclist volume "Bill Text - AB-1938 Traffic Safety: Speed Limits." 2022). To help address the issue of "speed creep," AB 43 also allows local jurisdictions to retain the prior speed limit posted on a roadway if no additional travel lanes have been added ("Bill Text - AB-43 Traffic Safety." 2021).

While AB 43 and AB 1938 made important improvements to the CA MUTCD to allow for increased local authority to set speed limits by considering safety and vulnerable road users, several limitations still exist with the current approach and ultimately, these changes do not reflect a Safe System Approach to SLS. First, SLS is still ultimately based on driver behavior, not safety targets, as speed limit reductions under AB 43 and AB 1938 remain tied to the 85th percentile of driver speeds (speed limits can, at most, be set to 12.4 mph below the 85th percentile speed) "Bill Text - AB-1938 Traffic Safety: Speed Limits." 2022). Additionally, AB 43 and AB 1938 still very much retain SLS control at the state level, with a limited scope for local authorities to make a small range of changes that must meet a very strict set of state-outlined criteria, further increasing the cost-prohibitive requirements previously discussed. One final limitation of the revised approach is that speed limit reductions under AB 43 and AB 1938 apply only to roadways outside of the State Highway System, while many of the high-injury roadways within local jurisdictions are the state highways which remain unaffected by this increased flexibility in SLS.

Institutional Resistance

Despite over a decade of studies highlighting the shortcomings of the 85th percentile, a recent study found that 98% of 175 traffic engineering professionals across the United States reported that they consider the 85th percentile speed when setting speed limits, but only 46% consider crash statistics, 36% consider context (i.e., surrounding land use), and 9% consider pedestrian or bicycle volume in conjunction with the 85th percentile speed (Kim, Kelley-Baker, and Chen 2019).

This institutional resistance is difficult to reverse, especially when previously proposed alternative approaches have generally been more complex, more difficult to utilize, or less objective. The 85th percentile is an objective and simple statistic that provides an almost irrefutable value, even if it may have no direct links to safety. Overcoming the barrier of using this simple, objective criterion within the traffic engineering profession is a critical challenge, and history shows that without sufficient motivation and legal requirements, professional behavior change is unlikely to occur.

NACTO's Approach to Setting Safe Speed Limits on Urban Streets

After extensive research on the issue, NACTO has recommended three primary tools to setting safe speed limits on urban streets: 1) Default Speed Limits, 2) Slow Zones, and 3) Corridor Speed Limits and Safe Speed Studies. These approaches can be implemented individually or as complements to one another, but each approach requires, to differing degrees, that local jurisdictions have authority to lower speed limits.

Default Speed Limits

If a jurisdiction has the authority to lower speed limits on many streets at once, they should consider setting a citywide default speed limit of 25 mph or lower. This maximum speed was chosen specifically with the safety of pedestrians, bicyclists and other vulnerable road users in mind. The default speed limit approach can provide predictability for drivers, is easy to communicate to the public, and is an inexpensive way to quickly improve safety outcomes (NACTO 2020).

In cities where there are clear distinctions between major and minor streets, it may also be appropriate to use "Category Speed Limits," or setting default speed limits by street type (e.g., 25 mph on arterials and 20 mph on local streets). This sort of context-specific default SLS can improve safety given the context while still maintaining a predictable driving experience (NACTO 2020). In California, the Functional Classification System used by Caltrans, which divides roadways within cities into groups such as arterials, collectors, and local roads, could make a Category Speed Limit relatively straightforward to implement (for example, with arterials set to 25 mph and collectors and local roads set to 20 mph) (NACTO 2020).

Slow Zones

Slow zones can be used by cities to address specific areas within a city that have high collision rates or are adjacent to sensitive land uses, such as schools or parks. The speed limit in slow zones is set lower than in otherwise similar streets on the basis of location-specific needs.

Areas adjacent to schools, parks, or senior areas might receive a "slow zone" designation and have speed limits set as low as 15 mph at all times, or only while the sensitive user is present (e.g., 15 mph adjacent to a school only during school hours, but otherwise a default of 25 mph). Because of safety concerns or high expected levels of multi-modal conflict, certain neighborhoods, downtown areas, or business districts might also be designated as slow zones, with a recommended maximum speed limit of 20 mph (NACTO 2020).

In California, school zones already are designated as special zones with respect to speed limits, but unless local jurisdictions specifically choose to enact a 15 or 20 mph speed limit on qualified roadways within their school zones (allowable under AB-321, 2007), their *prima facie* speed limit remains 25 mph, much higher than the 15 or 20 mph recommended by NACTO ("AB 321 Assembly Bill - CHAPTERED" 2007). Setting a 20 mph *prima facie* speed limit in business activity districts is now allowed under AB 43, but the strict criteria required for local jurisdictions to meet the definition of a business activity district may be prohibitive to study and document with respect to staff time. Further, under AB 43 state highways located within local jurisdictions are currently excluded from the "business activity district" designation even if they meet all the other outlined criteria ("Bill Text - AB-43 Traffic Safety." 2021).

Corridor Speed Limits and Safe Speed Studies

When local jurisdictions are required to conduct a speed study to set a speed limit, NACTO recommends a Safe Speeds Study, which analyzes the activity level and conflict density along a corridor and then sets the speed limit that will optimally minimize the risk of a person being severely injured or killed. By making the protection of people the central objective, Safe Speed Studies represent a Safe System alternative to percentile-based speed surveys (NACTO 2020).

Safe Speed Studies involve four components: data collection, analysis of existing conditions and SLS, the determination of speed management strategies, and evaluation of changes made.

1. Data Collection: in order to understand both existing problems on a corridor and also the potential for future problems, local jurisdictions should collect data, including current operating speeds (assessed through multiple metrics, including high-end speeding, speeding, standard deviation, median speed, and 85th percentile speed), speeding opportunities, history of fatal and serious injury crashes, and conflict counts along a corridor. These data should be collected both before any changes are made to speed limits, and then again after any changes occur (see step #4 below), so that local jurisdictions can evaluate the effectiveness of the changes.

2. Analysis of existing conditions and SLS: two major aspects of the existing conditions should be taken into account when determining a safe speed limit along a corridor - conflict density and activity level. Conflict density is the frequency of potential conflicts along a corridor and reflects how often a crash might occur unless sudden action is taken to avoid it. Activity level describes how active the corridor is, or is expected to be, in the near term. Most urban streets are either moderate or high activity. The matrix in Figure 2 below recommends speed limits based on a combination of conflict density and activity level. Rarely is a speed limit above 25 mph recommended in an urban setting.

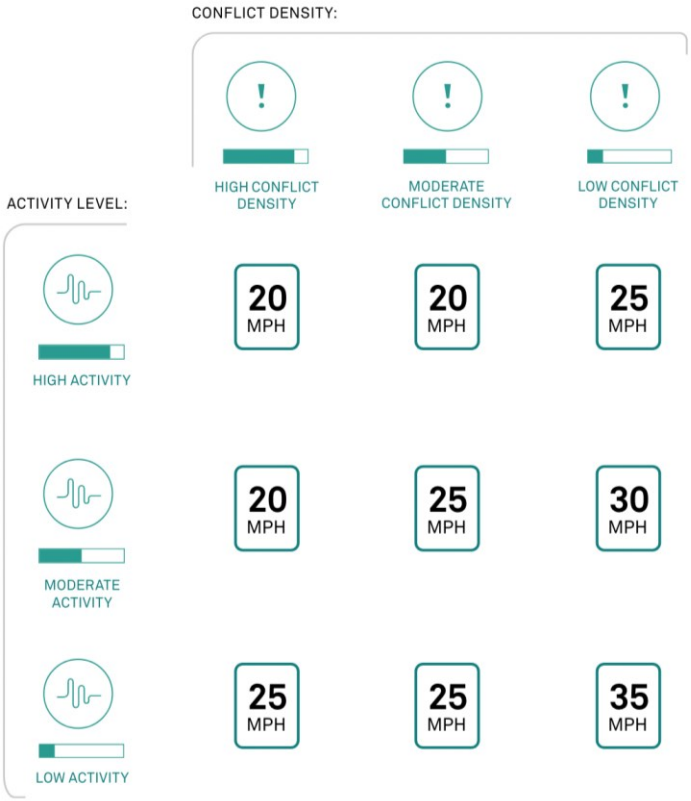

Figure 2: NACTO Safe Speed Study thresholds

3. Determination of speed management strategies: if pre-study operating conditions demonstrate a prevailing speed that is higher than the maximum safe speed recommended based on conflict density and activity level (i.e., the target speed), local jurisdictions will want to decide on which

speed management tools (e.g., changes to roadway design or operations, signage and markings, enforcement, or education) can best help them achieve the target speed.

4. Evaluation of changes made: data collected prior to the implementation of any speed management strategies (see #1 above) should be mirrored by the data collected after these strategies are put into place to evaluate the effectiveness of the work. Focusing post-intervention data collection and evaluation on longer term effectiveness (i.e., 6-months and 1-year post-intervention) will provide a more robust and accurate representation of the efficacy of the intervention.

Chapter 3 - Practitioner Perspective

To help support statewide efforts to increase safety for all roadway users, an overarching goal of this work is to develop a data-driven analysis that lays the foundation for implementing the Safe System Approach in California. A critical data element that will inform this analysis is a better understanding of current speed-limit setting (SLS) practices and their limitations, as well as any key state-level resources that could support a Safe System Approach.

Local- and state-level traffic engineers and other safety professionals are important stakeholders and excellent resources for providing insights into the strengths and barriers related to current SLS practices. Accordingly, one-on-one interviews were conducted with California-based state, regional and local practitioners to better understand existing practice for setting speed limits, current challenges, any desired changes to the current approach, as well as needed resources, tools and support. Directly assessed in these interviews was the impact of two recently passed legislative bills (AB 43 and AB 1938) on practice and how well their implementation could align with a Safe System Approach "Bill Text - AB-1938 Traffic Safety: Speed Limits." 2022).

To help provide further context for California's current SLS landscape and a move toward a Safe System Approach, it is also useful to look outside California to compare with efforts that are happening in other states or jurisdictions. Accordingly, non-California practitioners were invited to participate in a survey to share their reflections on SLS, including their observed challenges and opportunities of percentile-based and Safe System approaches.

Changing how California establishes speed limits will be a significant undertaking that must be evidence-based and supportive of the needs of transportation safety practitioners. This collection of reflections from interviews and survey responses represents an important step in understanding how best to proceed.

Approach

Interviews with California-based Practitioners

In order to better understand existing practice for setting speed limits in California, current challenges, and any desired changes to the current approach (including training or resources), an in-depth interview script was developed by SafeTREC researchers in collaboration with Vision Zero Network staff. The interview consisted of nine questions covering three distinct areas: 1) existing practices for setting speed limits, 2) recent California legislation affecting speed limit work, and 3) reflections on the Safe System Approach and needed resources. The interview script can be seen in Appendix 1.

Interview participants were selected to include a range of California state, regional and local practitioners, including rural, suburban and urban areas. If an invited participant was unable to participate, they were asked to provide the name and contact information of an alternative practitioner within their organization or someone who fills a similar role elsewhere. Non-Caltrans expert roles

included: City Traffic Engineer, County Public Works Management, and County Public Health Department Vision Zero Coordinator.

The in-depth interviews were administered during November and December 2022 on the phone or over Zoom. A total of nine California stakeholders were interviewed. Three of the nine were Caltrans experts (including both Headquarters and District Office staff), and all three Caltrans interviews were conducted by SafeTREC researchers. Six of the nine stakeholders interviewed were non-Caltrans experts working at the local or regional level. One non-Caltrans expert was a private sector engineer who consults on behalf of local and regional governments, and this interview was conducted by SafeTREC researchers. The other five non-Caltrans expert interviews were conducted by Vision Zero Network staff.

Interview responses were transcribed and reviewed by SafeTREC researchers. Where multiple interviewees provided similar reflections, these themes were summarized and grouped by type of practitioner (Caltrans vs. non-Caltrans) if applicable. Instances in which interviewees provided unique reflections were noted separately.

Survey Responses from non-California Practitioners

In order to provide further context for California's current SLS landscape, including the challenges and opportunities of percentile-based and Safe System approaches, a survey instrument was developed by SafeTREC researchers to be completed by US-based, non-California practitioners. The survey instrument consisted of six questions covering three distinct areas: 1) reflections on the 85th percentile approach, 2) recent California legislation affecting speed limit work, and 3) challenges and opportunities of the Safe System Approach. The survey instrument can be seen in Appendix 2.

The internet-based survey was developed in Qualtrics and distributed to nine potential respondents who were identified for their expertise in SLS and knowledge of the Safe System Approach. The surveys were sent in mid-March 2023, and by mid-April 2023 the survey had received four responses. SafeTREC researchers reviewed survey responses, and where multiple survey respondents provided similar reflections, these themes were summarized, while instances in which interviewees provided unique reflections were noted separately.

Findings and Discussion

Practitioners across a wide variety of settings, both within and outside of California and at state and local levels, provided thoughtful reflections on SLS, recent legislation, and the Safe System Approach. While not a statistically representative sample, these qualitative reflections provide insight into the experiences and perspectives of professionals working in numerous transportation settings. The statements made during the interviews and in the survey represent the viewpoints of the respondents, not their employers. A detailed summary of the reflections provided in both the interviews and the surveys can be found in Appendix 3 (Appendix 3: Practitioner Interview and Survey Responses).

Practitioners highlighted the serious challenges to achieving Safe Speeds and an overall Safe System Approach posed by the long-standing practice in California of setting speed limits in line with the 85th percentile speed, especially in urban areas. Numerous practitioners noted that even completing a valid E&TS to measure the 85th percentile speed can itself present challenges within urban settings and that the survey requirements may bias toward an overestimation of typical driver speeds in those areas.

While all practitioners interviewed or surveyed agree that reliance on the 85th percentile speed is objective and easy to explain, a system that bases speed limits on driver behavior was viewed by all city and county practitioners both within and outside of California as inappropriate for setting speed limits in urban areas and not aligned with safety goals. However, this view was not expressed by Caltrans staff, who mostly expressed that this driver behavior-based system is appropriate and safe, possibly reflecting a greater focus on rural or limited access roadways.

While there was widespread recognition that recent legislation (AB 43 and AB 1938) has improved the SLS approach, most practitioners viewed these laws only as interim strategies to allow for true context-based SLS procedures under a Safe System Approach. The biggest changes allowed with these recently passed bills are: 1) the extension of the maximum validity of the E&TS to from 10 to 14 years, 2) the ability to reset speed limits to prior values and help prevent speed creep, 3) an allowance for a 20 mph limit in business districts, and 4) the ability to eventually allow for up to a 12.4 mph reduction in speeds from the 85th percentile speed based on safety and presence of vulnerable users. Local practitioners are already taking advantage of the ability to better incorporate local context that is provided by changes #1-3 but expressed frustration at having to wait for the Judicial Council to be allowed to enact slower and context-relevant speed limits as outlined in change #4.

Significantly, AB 43 and AB 1938 exclude roadways that are part of the State Highway System. Accordingly, these laws made little difference to Caltrans practitioners except in that this approach leads to a lack of consistency between roads that are locally-controlled and those that are state-controlled. For local practitioners, the exclusion of state highways in recent legislation presented a major concern, as it meant that they still had no ability to adjust for context on state highways within their jurisdictions, even if these were high-injury roadways.

Ultimately, there was a significant desire among local practitioners to move completely away from a system that relies on driver behavior for SLS and move toward a truly Safe System that is focused on minimizing injury and is based on context. There was also widespread acknowledgement that, in order to achieve a true Safe System Approach, not only must speed limits be set according to safety and context, but redundancy must be added through additional measures such as engineering, education, and enforcement. To function optimally within the Safe System Approach, each of these additional approaches will require appropriate level funding and thoughtful implementation to achieve equitable roadway safety.

Chapter 4 - Case Studies

Given the current barriers to applying a Safe System Approach to SLS in California, it is useful to examine U.S. and international case studies of SLS practice. The sections below briefly summarize work conducted by Fehr & Peers for U.S. case studies and the ZTFTF for international case studies and provide a more detailed description of a new international case, New Zealand.

U.S. Case Studies

Fehr & Peers was separately tasked to explore and share examples of situations where utilizing a Safe System Approach can have a more favorable outcome than existing practices (Fehr & Peers 2023). This was done from a SLS perspective, and they identified and compiled several brief case studies that contain examples and analyses of the Safe System Approach and explored how the approach could be applied in the California context. The case studies, listed in Table 2, reflected a range of cities, MPOs, and states within the U.S.

Table 2: Speed Limit Setting Case Studies (Fehr & Peers, 2023)

Case Study	**Location**	**Year**
Washington HB 1045	State of Washington	2013
Seattle Citywide Default Speed Limit Reduction	Seattle, WA	2015
Oregon Speed Zones	State of Oregon	2020
Cetco Avenue Speed Limit Reduction	Brookings, OR	2021
Portland Residential and Business District 20 mph Speed Limits	Portland, OR	2017
Boston Default Speed Limit Reduction	Boston, MA	2017
New York City Speed Safety Cameras	New York, NY	2013
Sacramento Vision Zero: Reducing School Speed Zones	Sacramento, CA	2021
Tenderloin Speed Limits and No Turn on Red	San Francisco, CA	2021
San Francisco Slow Streets	San Francisco, CA	2020

These case studies included examples of default speed limits and context-based speed limits used in other states. In most cases, when context (such as land use or street type) was added as a consideration, the SLS approaches still rely on some measurement of driver behavior, either 85th or 50th percentile speed. While not moving all the way toward a Safe System Approach, these case studies provide valuable insights on the ways to incorporate context and the types of speed management approaches that can make revised speed limits more effective at achieving desired safety outcomes (Table 3). None of these case studies examined speed limit changes as an isolated intervention, so it is not possible to draw conclusions

about the effects of speed limit changes independent of the other interventions (e.g., increased signage, automated speed enforcement, infrastructure changes).

Table 3: Context-Based Recommendations (from Fehr & Peers, 2023)

Context Comes First		
Case Study Key Point	***Implication***	***Potential Action***
The City of Brookings studied several segments of the same roadway, but only lowered the speed limit on two of those segments - based on context and observed speed determination in Oregon's Speed Zones methodology.	Emphasizes the importance of evaluating locations on a hyper-local level to determine appropriateness of speed limits.	Expand specificity of local context definitions in current law, such as sub-categories of business districts, based on specific land uses.
ODOT's Speed Zones program includes a distinction for "rural communities," which is based on corridor characteristics, regardless of incorporation status.	While the principle of "rural communities" could be indirectly derived through current California law language, including this straightforward term could make local flexibility options more accessible to under-staffed rural agencies for which it applies.	Include more descriptive special definitions in guidance that helps communities identify which options are relevant/applicable.
New York City's ASE was deployed near schools and speeding at those locations decreased.	Speed limit setting can be systemic, focusing on a particular subset of vulnerable roadway users, and based on locations that serve those users.	Consider a methodology that starts with people (vulnerable groups) and then continues to context (built environment), such as an ASE pilot near schools.
Boston, Portland, Seattle, and SFMTA (Tenderloin) all undertook highly consistent, across-the-board (citywide or neighborhood-wide) speed limit modifications based on context, many of which saw a reduction in top-end speeders.	Across-the-board default speed limits may reduce flexibility but could improve driver understanding of speed limits. Consistency doesn't need to be citywide or even neighborhood-wide, but could have a level of consistency that everyday users, not just traffic engineers, can understand and remember.	Consider default speed limits that are easily communicated and memorable as to their context (i.e. "20 in the Tenderloin"), not just posted on speed limit signs.

Redundancy is Crucial in a Safe System		
Case Study Key Point	***Implication***	***Potential Action***
The City of Seattle introduced context-based speed limits with infrastructure countermeasures, while the City of Brookings evaluated speed limits in anticipation of infrastructure countermeasures.	A truly Safe System Approach requires redundancy across elements at all stages of safety evaluation – *whether the speed limit is modified or not.*	Allow for "temporary speed limits," like that described in *5. Oregon Speed Zones*, for simultaneous countermeasure and speed limit implementation, if the countermeasure changes the context.
New York City leaned-into enforcement, while the City of Seattle emphasized engineering redundancy in pedestrian safety.	While inclusion of more Safe System elements increases redundancy, complementary countermeasures do not need to be limited to engineering design; enforcement, including automated enforcement, can complement the speed limit.	Consider alternatives to automated speed enforcement, which is not currently legal in California. Potential options could include automated red-light enforcement combined with speed-related signal timing modifications, such as lower "green band" coordination travel speeds, automatic recall of minor streets or pedestrian signals on high-speed corridors, or signal rest-in-red during off-peak hours.
SFMTA introduced right-turn-on-red restrictions in the Tenderloin along with 20 mph speed limits.	While speed-related collisions may be the impetus for investigation into a certain corridor or area, implementation that supports a Safe System should not be limited to speed-related countermeasures.	Consider preparing a list of "bundle-ready" countermeasures, that can be rolled out in complement to speed limit modifications at a relatively low cost, depending on the context. Potential countermeasures could include RTOR restrictions, increased number of speed limit signs, quick-build curb extensions, larger stop signs, leading pedestrian intervals, etc.
Seattle installed additional posted speed signs on some corridors, without a speed limit modification, and still observed a decrease in high-end speeders.	If speed-related collisions are an issue along a corridor, what is the root cause of the speed? *Is the speed limit too high?* *Is the speed limit appropriate, but drivers just are not aware of the speed limit?* *Are drivers aware of the speed limit, but do not follow it?* Answering these questions incorrectly could lead to the wrong solutions.	When investigating corridors with a high percentage of high-speed collisions, leverage collision data as well as traffic stop data to attempt to identify the root cause of speeding. If this data is not available, coordinate with law enforcement to attempt to collect this data in the future.
Boston, Portland, and SFMTA introduced informational signage, in multiple languages, to educate the public on the new speed limits, including "20 is plenty" and "20 in the Tenderloin" slogans.	Not only can informational signage help to alert drivers of the speed limit changes, but it can help the public understand the root cause of the intervention – to save lives, not to create speed traps.	Include customized, memorable, and relatable informational signage to get drivers accustomed to modified speed limits and anchor the changes in Safe System goals. Collaborate with leaders in the individual community receiving the modification to create a unique and community-specific educational campaign.

International Case Studies

The ZTFTF Research Synthesis describes the examples of how the Safe System Approach had been applied to SLS regulation in other countries at the time of publication (Grembek et al. 2020). The primary examples at the time were Sweden, the Netherlands, and Australia. Since then, New Zealand has issued a revised report, Land Transport Rule: Setting of Speed Limits 2022, along with comprehensive speed management guidance, described in the following section (Waka Kotahi NZ Transport Agency 2022a).

New Zealand Speed Limit Setting

The speed management framework in New Zealand (Chiarenza, et al. 2023) is designed around a set of guiding principles shown in Figure 3 (Waka Kotahi NZ Transport Agency 2022b). These principles are generally aligned with Safe System principles, including that death and serious injury are unacceptable, humans are vulnerable, and redundancy is crucial, but they also explicitly address the importance of context and equity.

Figure 3: Guiding principles for speed management in New Zealand (Waka Kotahi NZ Transport Agency, 2022)

New Zealand's SLS approach is designed to set safe and appropriate speed (SAAS) limits that are aligned with Safe System standards for safety and with community objectives, the intended uses, and the

roadway design. Setting of SAAS limits requires the following inputs (Waka Kotahi NZ Transport Agency 2022b):

- "the Safe System speed thresholds for crash survivability
- "the One Network Framework street categories that reflect the movement and place functions of a street or road
- "the infrastructure risk rating, which is a road assessment methodology to assess road safety risk
- "the presence or planned implementation of safety infrastructure to reduce the risk of harm for people outside vehicles (for example, bike lanes and raised crossings)."

The speed thresholds and One Network Framework (ONF) are considered 'baseline factors' because they are either based on well established evidence or nationally consistent datasets, while the infrastructure risk rating and safety infrastructure, both based on local data, are considered 'moderating factors.'

The ONF is represented in a national dataset that defines street categories based on the movement and place principle for each segment of the road network. The movement and place principle highlights the need for a road to move both people and goods while also serving as a destination for people, including vulnerable road users. The ONF groups categories of streets according to the relative importance of movement and place. See Figure 4 for a diagram of the street categories for urban and rural roads in New Zealand with examples of each. The movement axis is based on the need for movement of people or goods and the place axis is defined by adjacent land use and the volume of pedestrians or bicyclists.

This nationally consistent set of categories is the foundation for setting SAAS limits in New Zealand. For each category, there is a baseline SAAS and a range of possible speed limits. The baseline is the starting point, but an agency may adjust the speed limit based on local data. In most cases, the speed limit could be increased if there are additional Safe System countermeasures on the road or the speed limit may be decreased if there is a higher infrastructure risk rating.

New Zealand also requires that speed limit changes be developed and implemented through a speed management plan, which is a document that is revised every three years and outlines a transportation agency's 10-year vision and 3-year implementation plan for speed management. This effort requires that agencies be systematic about the transition to new speed limits, consider the network as a whole, and prioritize funding for speed management. In terms of regulatory implementation, the Land Transport Rule: Setting of Speed Limits 2022 outlines the authority of agencies to set speed limits and describes the requirements for development of the speed management plans and the process for review and certification. The Speed Management Guide: Road to Zero Edition and One Network Framework: Detailed Design - D02:2022 provide the technical guidance on the SLS methodology for agencies and practitioners 2022b).

Figure 4: One Network Framework street categories and examples (Waka Kotahi NZ Transport Agency, 2022)

Chapter 5 - Summary of Findings from Tasks

The recommendations presented in this report for Developing a Safe System Approach to Setting Speed Limits stem from a review of the relevant research, interviews and surveys with US-based transportation professionals, and a series of U.S.- and international-based case studies where speed limits (regulatory or advisory) were restructured or reduced. These findings are grouped below by theme for greater clarity.

Research on Percentile-Based Speed-Limit Setting

The Research Synthesis for the AB 2363 ZTFTF found that "there is no empirical study that demonstrates that the 85th percentile speed optimizes safety," but on the contrary, that "drivers have limited capability to self-regulate a safe speed [especially] at lower speed areas" (Grembek et al. 2020). The risk of unsafe speeds is overwhelmingly borne by pedestrians and bicyclists – in California, pedestrian fatalities were up 70% between 2012 and 2021 ("Pedestrians Killed in Fatal Crashes - California, 2012-2021" 2023), and the number of bicyclist fatalities and serious injuries increased by 18% between 2013 and 2022 ("Statewide SWITRS Summary - Bicyclist Fatalities and Serious Injuries" 2023). As noted by the Federal Highway Administration, the current system of speed limit setting "produces speeds that may not be safe for all road users"(Kumfer et al. 2023).

The importance of appropriately-set speed limits to improve safety outcomes is supported by research, particularly in international settings, demonstrating that independent of any other countermeasures and changes to roadway design and operations, lowered speed limits decrease mean speed, reduce the speed of the fastest drivers, and improve safety outcomes (Grembek et al. 2020).

Advantages and Disadvantages of California's Current Speed-Limit Setting Approach

The current approach to SLS in California is anchored in a driver-behavior, percentile-based approach. The main advantage of this approach is that it is objective, easy to measure and easy to explain. However, there is concern, especially among transportation practitioners operating in urban and suburban areas, that the current approach is not aligned with promoting safety for all road users. There are a variety of reasons for this.

First is a concern expressed by several practitioners during the interview/survey process, that the E&TS used to measure driver behavior is likely to bias toward driver speeds that are higher than the most commonly observed driver speeds. Specifically, the requirement that the E&TS be performed under optimal travel conditions (i.e., clear, dry, daylight, free flow conditions) means that the 85th percentile speed measured during the E&TS will always be the maximum 85th percentile speed, not the typical 85th percentile, thus pushing speed limits to be set higher than may be safe for all road users, especially in urban areas where free-flowing traffic is not typical.

Further, even with safety-based considerations enabled through recent legislation (i.e., AB 43 and AB 1938), by continuing to be anchored in percentile-based driver behavior metrics, California's SLS approach creates a "hard floor" for a speed limit (i.e, no more than 12.4 mph below the measured 85th percentile speed), even if safety concerns would dictate otherwise.

Overall, and especially in urban areas, there is consensus that percentile-based approaches are not well-aligned with safety goals, and there is a desire by many local practitioners to move completely away from a driver-behavior-based system for SLS and move toward a truly Safe System that is based on context and focused on minimizing injury and death.

Improvements and Remaining Challenges Associated with AB 43 and AB 1938

Passed in 2021 and 2022 respectively, and specifically in response to the short-term recommendations of the ZTFTF (AB 2363 Zero Traffic Fatalities Task Force 2020), AB 43 and AB 1938 have been viewed as positive steps in the right direction for achieving a context-sensitive approach to SLS. The changes enabled by these pieces of legislation have allowed local jurisdictions to fight "speed creep," reprioritize valuable staff time by extending the valid length of an E&TS, and begin making some safety-related, context-specific changes to speed limits. "Speed creep" refers to a phenomenon of ever-increasing speed limits because faster measured driver speeds require increases to speed limits and then higher speed limits prompt motorists to drive faster, again prompting a further increase to speed limits.

However, the changes stemming from AB 43 and AB 1938 are only interim strategies in pursuit of fully context-based SLS under a Safe System Approach. This is because, even once fully implemented (in June 2024, or once the Judicial Council has developed an online tool, whichever is sooner), the changes enabled under AB 43 and AB 1938 will still require significant staff time and costs to periodically conduct an E&TS on all roadways, SLS adjustments for context and safety will exclude roadways on the State Highway System, and ultimately, the system will continue to be tied to driver behavior, not safety outcomes.

Speed-Limit Setting using a Safe System Approach Necessitates a Focus on Context

In order to move away from a driver-behavior, percentile-based approach to SLS and toward a true Safe System Approach that centers and promotes the safety of all road users, there is a need to set speed limits according to context. Context refers to the functional classification of the roadway (or the character of service it provides), the surrounding land use patterns, the density and activity level of vulnerable users like pedestrians and bicyclists, and the presence or absence of roadway design features.

The importance of context is particularly salient in urban areas that contain many different roadway types within a small geographic area and higher densities of vulnerable road users. On urban streets,

NACTO has recommended that speed limits that center safety should generally not exceed 25 mph and lower speed limits might be considered depending upon context (NACTO 2020).

The emphasis on allowing greater "local flexibility" to set speed limits within California and other states relying on percentile-based approaches has largely arisen because these percentile-based approaches are not context-based and safety-oriented. Accordingly, the desire for greater "local flexibility" has been expressed as being more about allowing local jurisdictions to get "the right answer" for SLS with respect to safety than being about gaining local control over the process. If a context-sensitive approach defined at the state level could successfully center safety and minimize injury, it is likely that local practitioners would find merit in this approach.

A Safe Speed Limit is Enhanced by Complementary Countermeasures

Research clearly supports the relationship between setting safe and appropriate speed limits and improved safety outcomes. However, SLS is only one of several tools that can and should be used under the Safe System Approach to achieving Safe Speeds. In addition to implementing a SLS approach that depends on context and centers safety, additional countermeasures enhance the effectiveness of speed limit changes as a speed management strategy. Additional countermeasures that add to a Safe System's redundancy include roadway engineering changes, increased/improved signage, media and educational campaigns, and effective and equitable enforcement.

Chapter 6 - Recommendations for California

Most practitioners, whether or not they are in favor of the driver-based SLS approach currently employed in California, will acknowledge its benefit of being objective and straightforward to apply. This benefit does not outweigh its other disadvantages but obligates a focus on objective, evidence-based SLS methods that are more likely to overcome institutional resistance to change.

A Safe System Approach to SLS for California must prioritize the safety of all road users, which cannot be done while relying on drivers to choose a safe speed. The *responsibility is shared* principle applies not only to the road users but also to the government agencies that are designing the roads and setting speed limits. Elements of the Safe System Approach have been applied to SLS practice in other states around the U.S., but these efforts have been piecemeal. The best examples of leadership and alignment with the Safe System are found internationally. New Zealand's SLS framework, by using the *Movement and Place* principle to define road function and SAAS limit ranges informed by Safe System research, represents a comprehensive and flexible approach to the Safe System. Its use of a nationally-consistent dataset of context-sensitive street categories demonstrates how speed limits can be set on an entire network using a consistent and objective approach.

California's large geographic size, population, and economy make it difficult to find a perfect correlate among other states or countries. New Zealand, however, has historic, cultural, and demographic parallels that make for useful comparison. In particular, both New Zealand and California are largely auto-dependent with similar mode shares of driving, walking, and bicycling New Zealand Government 2015). Unlike the European innovators, both have seen most of their urban development occur in the past 150 years. New Zealand's SLS framework was only adopted in 2022, but they adopted the Safe System Approach as part of their 2010-2020 Road Safety Strategy (New Zealand Ministry of Transport 2010). Between 2010 and 2021, pedestrian fatalities decreased 29% in New Zealand while they increased 70% in the U.S. (Chiarenza, et al. 2023).

Shifting to a Safe System Approach to SLS requires a shift in the thinking on SLS for California. Under the current approach, speed limits are based on driver behavior and agencies that want to reduce speed limits to improve safety – beyond reductions allowed by current regulations – must install infrastructure countermeasures to reduce operating speeds sufficiently that an E&TS can justify the desired reduction. With a Safe System Approach, as employed by New Zealand, speed limits are set to minimize the risk of fatal or serious injuries to the type of users on a roadway. If an agency has an operational need to increase the speed limit, they must install Safe System countermeasures to protect the road users most at risk. This approach is aligned with the principle and ethical imperative of eliminating fatal and serious injuries, but it also requires proactive efforts at speed management, such as re-designing streets, and not be limited to more reactive efforts, such as enforcement.

The following sections discuss the legislative and technical recommendations for translating New Zealand's approach to California and anticipated challenges to implementation.

Translation to California

Implementation of this Safe System Approach to SLS in California will require technical, engagement, and legislative efforts, some of which could potentially be conducted simultaneously to more quickly achieve safety objectives. It took New Zealand 10 years to develop and adopt its SLS approach, but California can move more quickly by learning from New Zealand's process and the stages they used with rollout. The technical recommendations below are based on publicly available resources from New Zealand, but a full picture of their rollout effort will require consultation with local experts.

Technical Recommendations

The technical steps for implementing a Safe System Approach to SLS include defining the street categories with different speed limit needs for California, determining the baseline and range of safe and appropriate speed limits for each of those categories, and establishing a process for altering a speed limit from the baseline. The sections below describe the datasets and processes that will support the development of speed limit setting guidance for inclusion in the CA MUTCD.

Street Categories

California should develop its own state-level street category framework, an equivalent to New Zealand's One Network Framework, based on the *Movement and Place* principle and the state's own built environment patterns. The street categories should capture the relative importance of movement and place on each street or road segment. The objective is to have a uniform dataset that applies to the entire network of roads in the state and less room for subjectivity in the determination of speed limits. There are a number of related datasets and research efforts that could prove useful for developing this framework. Overlaying movement and place datasets would provide detailed categories that could be grouped into appropriate street categories to capture the desired variation in streets and roads within the state.

Movement is already well-defined on roads nationally according to the Federal Highway Administration (FHWA) functional classification and available statewide in the California Road System (CRS) dataset. Each road in the state is assigned a functional classification indicating the relative importance of mobility, including interstates, other freeways and expressways, other principal arterials, minor arterials, major collectors, minor collectors, and local roads. Local roads, mostly residential streets or small rural roads, make up most of the road network. There is no reason to reinvent the wheel for measuring movement when this comprehensive dataset already exists.

The *Place* principle should capture the expected level of on-street activity on a given segment, which could be measured with land use and other data that correlate with greater pedestrian or bicyclist activity. The length of road segments for application of street categories depends on the approach used, but factors that will be considered include intersections with other functional classifications and boundaries of the other data sources used. New Zealand set minimum segment lengths for each speed limit, increasing with speed. Existing efforts demonstrate how the context part of the equation could be measured objectively:

- The Place Types defined as part of the Smart Mobility Framework (SMF) (Caltrans 2022). These are defined at the Census tract-level and include two urban, one suburban, and three rural place types. This scale is too broad, but the categories could be supplemented with additional data on land use, “such as school and retail locations.
- The SMF Place Types are based on research funded by the California Air Resources Board (Salon 2015), which included more categories at the same scale. These data could also be supplemented with additional data on land use or the methodology could be reproduced at a smaller scale, such as blockgroup-level.
- EPA’s Smart Location Database (US EPA 2014) is updated by EPA approximately every 10 years (following the decennial census) and contains blockgroup-level data on over 90 attributes, such as housing density, diversity of land use, transit service, and demographics. These variables could be weighted and combined to develop a measure that estimates the level of on-street bicyclist and pedestrian activity.

The street category of a given segment may not be static over time as development patterns change in parts of the state so it is important for the State to have a process for periodically updating the categories on each segment within California (however, the vast majority of roadway segments across the state are unlikely to change following any one update). This requirement reinforces the importance of having an objective, quantitative method to establish the categories. Also, understanding the limitations of large datasets, the State will need a process for local review of and input on street category assignments to align with local planning.

The work to develop the street categories should be conducted by a multidisciplinary team of researchers, including experts on transportation safety, urban planning, and geographic information systems (GIS). Stakeholder feedback and iteration during this work will be important to help researchers ensure that practitioners feel the final street categories are accurate representations of their local context.

Considerations for Speed Limit Ranges

Once a framework for street categories is established, the State needs to define the remaining process for setting speed limits.

Safe and Appropriate Speed Limit Ranges

Baseline SAAS limits and ranges for each street category should be determined based on the extensive existing Safe System research, with a goal of minimizing risk of fatal or serious injury to the expected types of road users. A great deal of research already exists to draw from, so this step would primarily consist of a comprehensive literature review to justify the selections.

Risk Assessment Method

A roadway risk assessment method can be used to evaluate the risk level to the expected users of a road and determine whether the speed limit must be reduced below the baseline due to additional risk or can be raised above the baseline due to presence of Safe System countermeasures. New Zealand

developed the Infrastructure Risk Rating (IRR) method specifically for SLS and it has been applied in Australia as well. The method was initially intended to be collected manually from Google StreetView or satellite imagery, but others have run the analysis using existing datasets (Zia, Durdin, and Harris 2016). IRR assesses risk based on eight key road and roadside attributes, including land use, road stereotype, carriageway width, horizontal alignment, roadside hazards, intersection density, access density and traffic volume. Each of these variables is coded and assigned a category score based on the value (e.g. 8.0 for commercial strip shopping, 1.5 for rural residential). The final IRR score for the road is calculated using a multiplicative log equation using each of the category scores.

Next steps would be to identify existing risk assessment methods, screen them for practicality of application in California, apply the screened methods to case study jurisdictions, and evaluate the performance. Subsequently, the State should define how the best performing method should be employed to determine variations to SAAS limits within the ranges appropriate for each street category.

Engagement Recommendations

Stakeholder engagement and buy-in are critical to successful implementation of a new SLS approach in California. One potential approach would be to establish two working groups or task forces to engage the significant expertise and subject matter knowledge from state and local practitioners and policy experts. The potential membership and responsibilities of these groups are described below.

Technical Working Group

The technical working group or task force would be made up of traffic engineering and planning practitioners at the state and local level with knowledge of the challenges faced by agency staff in the day-to-day practice of SLS, speed management, and Vision Zero implementation. This group would evaluate the products from the technical steps outlined above and provide feedback to the research team on how to make the products more feasible for implementation. Jurisdictions represented by group members could be considered for pilot application and evaluation of the street category framework.

Policy Working Group

This policy working group or task force would be made up of legal and policy experts and decision makers from Caltrans, CHP, and other state and local departments and agencies. The legislature could reconvene the ZTFTF, or the legislature, Caltrans, or CalSTA could convene a new task force or working group. The focus of this group would be on development of the language for legislation to update the California Vehicle Code (CVC) sections on SLS. They would determine what requirements of SLS must be specified in the CVC (e.g. a statewide maximum speed limit) vs. in other guidelines such as the California Manual for Setting Speed Limits. They would also determine whether to require speed management plans, as recommended in the next section.

Legislative Recommendations

Current state regulation of SLS has been applied in a piecemeal fashion, with relevant information in multiple nonsequential sections of the CVC. For clarity, the state legislature should pass legislation that replaces current SLS-related regulations within the CVC, rather than adding new exceptions. Specific details of the methodology used to set speed limits should not be specified in the legislation in order to allow the State to stay current with best practice in speed management. Instead, similar to New Zealand regulation, legislation could focus on context-based SLS, requirements for whole-of-network application of speed limits, and a process for developing speed management plans – including objectives, implementation plans, and justification that speed limits are safe and appropriate – as well as coordination between agencies for consistency in speed limits. The details of New Zealand's regulation can be seen in the Setting of Speed Limits Rule (Waka Kotahi NZ Transport Agency 2022a). While a speed management plan requirement will require additional effort for agencies, it will allow local transportation agencies to have greater control over speed limits and speed management strategies within their jurisdictions. There could also be flexibility around incorporating a speed management plan into existing plans such as Local Roadway Safety Plans or Vision Zero Plans. Additionally, the network-wide approach to SLS will reduce the effort of conducting an E&TS on a case-by-case basis to maintain enforceability of speed limits on individual streets. Developing the technical details of this new SLS approach are most appropriately handled by researchers and other technical experts.

How Local Jurisdictions would Set Local Speed Limits

Once the Technical Framework has been established, each jurisdiction will need guidance and a process for setting their local speed limits. This guidance would be developed by Caltrans and incorporated into the CA MUTCD. See Figure 5 for the proposed workflow for the SLS process.

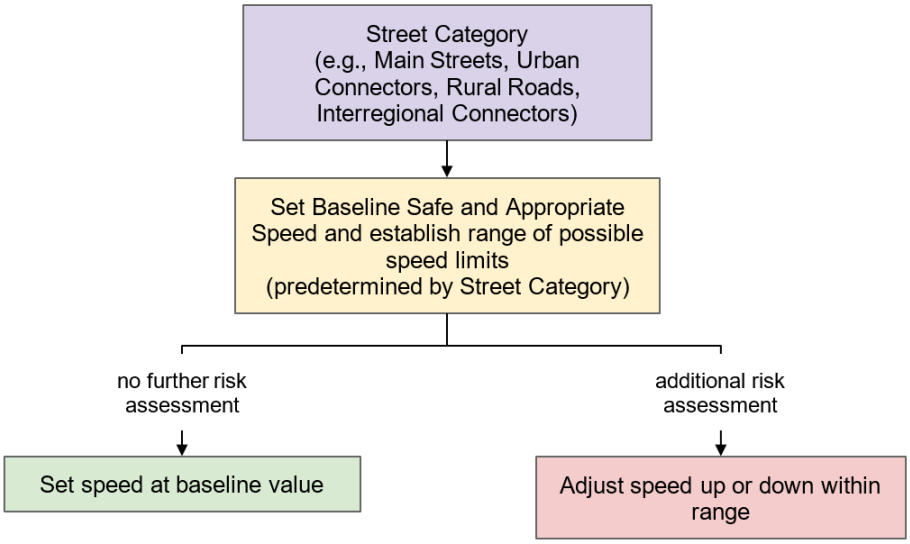

Figure 5. Proposed workflow for setting speed limits

Challenges to Implementing a Safe System Approach to Speed-Limit Setting

While the ethical imperative to save lives and minimize injury must ultimately drive transportation safety professionals and California lawmakers to adopt a Safe System Approach to SLS, understanding the challenges that such a shift will face is an important undertaking. Challenges to adopting a Safe System Approach to SLS will be experienced in multiple dimensions and at different time points: first, there will be challenges as legislation to make this shift is drafted and debated in the political sphere; next, there will be challenges as transportation professionals are expected to adopt and implement this new approach; and finally, there will be challenges to ensuring that the new approach to SLS is optimally effective in promoting traffic safety.

Challenges for the Political/Legislative Process

In order for California to shift SLS from a driver-behavior approach to a Safe System Approach, there must be the political will from legislators to champion such a shift, which will require substantial education of legislators around the deficiencies in the current approach and the advantages of a Safe System Approach. This will be critical because these deficiencies may not be readily apparent to lawmakers who neither understand the current percentile-based approach to SLS, nor are they likely to understand how a context-sensitive approach could greatly improve public health.

Once a bill has been sponsored and introduced, it may face pushback from the general public and from some industry and professional groups. The general driving population may be frustrated by any proposed legislation that might ask them to reduce their speed, especially when the rising traffic safety crisis is predominantly occurring among those outside of vehicles and thus drivers may be unconcerned or unaware of the need for change. Further, if the safety motivation behind any proposed legislation is not clearly construed, resistance from the general public might also arise if the lowering of speed limits in many locations is perceived to be part of a “money grab” related to increased traffic enforcement to generate revenue.

Objections to a shift to a Safe System Approach to SLS may also arise from a number of labor groups, industry representatives and/or non-profit organizations. Labor and industry groups representing those involved in transportation work (such as those related to goods movement, ride-hailing, or construction trades) may express concern that the changes to SLS procedures will slow their work and result in financial losses. And similar to potential public objections related to revenue generation from increased traffic enforcement, civil rights groups may object that the negative externalities of any increases in enforcement will be disproportionately borne by low-income communities and communities of color, especially as it relates to increases in fines and fees for those least able to pay and increases in interactions with police and the potential for conflict.

Finally, as any legislation supporting a shift to the Safe System Approach to SLS makes its way through the legislative process, there are likely to be numerous changes and amendments to any originally

drafted proposal. It is critical that the intent and integrity of the Safe System Approach to SLS be maintained in the face of such amendments.

To counter public, organizational and legislative pushback, it will be critical for legislators, transportation professionals and public health professionals to be clear in the messaging around this legislation. This could include a substantial public education campaign around the dangers of speed and the disturbing trend in traffic deaths, particularly amongst people walking and biking, and highlighting that this trend is uniquely being experienced in the United States. This type of educational campaign – ideally with a component to familiarize media and policymakers with the issues – would also need to underscore the ethical imperative to center safety and minimize injury on our roadways, and that slight inconveniences are worth the lives saved. Finally, it must be made clear that this new approach is entirely about improving safety outcomes, not about revenue generation, and measures must be taken within the legislation to assure that it is carried out in an equitable and transparent manner.

Challenges for Adoption and Implementation

First developed in the 1930s and widely placed into adoption in the 1960s, the 85th percentile approach to SLS is appealing both because of its longstanding use and its simple, objectively measurable outcome (Grembek et al. 2020). It is clear how to calculate the 85th percentile speed through an engineering and traffic survey (E&TS), and the E&TS results are easily interpretable by any traffic engineer within the state. The 85th percentile approach to SLS has been employed consistently in the same manner for the entirety of the careers of all practicing traffic engineers in California. As such, and as is the case with any major shift in methodology within a profession, a move away from a driver-behavior approach to SLS and over to a context-sensitive, Safe System SLS approach will face significant institutional resistance.

Understanding both the historical context under which the 85th percentile approach to SLS was developed and the characteristics of the transportation professionals currently raising concerns about a percentile-based approach can best help inform why and where institutional resistance might be most significant.

Historically, the 85th percentile approach to SLS was developed on the basis of driver behavior and safety concerns on rural two-lane highways (Grembek et al. 2020). On these rural highway settings, as well as on limited access interstates and expressways, where there is limited commercial activity and a negligible level of pedestrian and bicyclist activity, basing speed limits on the behavior that feels safe for drivers may make more sense. The context-sensitive approach for setting safe and appropriate speed (SAAS) limits (patterned off of New Zealand's Speed Management Guide) does an excellent job at distinguishing between these types of facilities by separating rural and urban areas, and further classifying roadways based on both movement and place (Waka Kotahi NZ Transport Agency 2022b). By implementing this framework, many California rural roads and limited access roadways may not experience reductions in speed limits because their context (i.e., movement and place) won't require it to promote safety for those traveling outside of motor vehicles.

On the other hand, roadways in urban areas are often extremely complex, with a significant diversity of land uses and a high density of vulnerable pedestrians and bicyclists. While the 85th percentile approach to SLS was developed for rural highways, and it was assumed that this approach could apply equally well to all roadway environments, this assumption has been widely criticized as inappropriate by transportation professionals working in primarily urban areas, where deaths of vulnerable road users have been consistently on the rise over the past 10+ years. By setting context-sensitive SAAS limits on the basis of New Zealand's Speed Management Guide, many urban areas would see reductions in speed limits which would correspond much more closely with the speeds that local practitioners in these areas have expressed as being appropriate given the urban context.

The history of SLS approaches in California, how speed limits might (or might not) change in different locations, and the agencies responsible for those roadways is important to consider in understanding possible institutional resistance to a SLS change and developing strategies to counter it. In terms of annual vehicle miles of travel (AVMT) on California roadways, Caltrans is responsible for 58% of roadways, while local jurisdictions (cities and counties) are responsible for 42% (Caltrans 2021).

With a significant focus of Caltrans' responsibilities being on rural highways, interstates and other limited access facilities, it will be important to provide education to Caltrans staff that reinforces the idea that a new Safe System SLS approach will likely have little effect on the speed limits posted on these roadway types, since many Caltrans professionals have asserted that the current speed limits on these roadways (set using 85th percentile driver speeds) are working well. For the smaller percentage of state highways operated by Caltrans that are embedded in complex urban environments, education around the ethical imperative of elimination of fatal and serious injuries through speed reduction will be important. Workshops between Caltrans staff and local and regional transportation agencies could facilitate this type of education, with local practitioners sharing their experiences around their efforts to improve safety outcomes on these state-controlled roadways within their jurisdictions.

It is expected that local and regional transportation practitioners will be much more supportive of a move to a Safe System SLS approach and the potential for lower posted speed limits given their expressed concerns about the current approach and its inflexibility to set speeds limits at a level that is safe and appropriate for the complex urban environments that they oversee. The most significant challenge with respect to these practitioners will likely be that methodology for developing the "place" classification will need to closely approximate their perceptions of the local place characteristics, neither over- nor under-estimating the complexity of the land uses and travel patterns within their particular jurisdiction. Strong stakeholder engagement, feedback and iteration during the development of the "place" classification methodology will be critical to ensuring that urban practitioners see a new SLS approach as "getting it right" for their jurisdictions.

Challenges to Adding Redundancy for a Safe System

Setting a safe and appropriate speed limit is only one piece of an overall speed management strategy to help California achieve a Safe System, which by definition, should be redundant in nature. Research is abundantly clear that additional countermeasures, such as roadway engineering changes,

increased/improved signage, media and educational campaigns, vehicle technologies like intelligent speed adaptation, and effective and equitable traffic enforcement can enhance the effectiveness of speed limit changes as a speed management strategy (Venkatraman et al. 2021). Despite clear evidence, challenges to implementing each of these countermeasures exist.

Roadway engineering changes represent a longstanding and evidence-based countermeasure employed by traffic engineers to help slow the operating speed of vehicles on a roadway. Many specific engineering approaches to reduce speed are supported by a wide variety of transportation professionals, including the Federal Highway Safety Administration, the Institute of Transportation Engineers, and the National Association of City Transportation Officials NACTO n.d.). The major barrier to implementing these engineering changes is one of cost. The capital improvement costs required to build out projects that successfully slow vehicle speeds are typically thought of as too high for engineering changes to be considered a rapid countermeasure to accompanying a shift to a Safe System SLS approach, though recent innovations with quick builds are making rapid engineering changes more realistic given their lower costs. Despite the challenge of implementing permanent engineering solutions quickly, they remain an incredibly important tool for speed management across California.

Increased or improved signage (including increased density of speed limit signs), as well as media and educational campaigns are likely the lowest hanging fruit for increasing redundancy within the Safe System Approach once a context-sensitive approach to SLS has been implemented. However, these two approaches (even in combination with setting a safe and appropriate speed limit) are unlikely to see safety gains sufficient to achieve Safe System objectives, which would require other countermeasures to be implemented.

Intelligent speed adaptation (ISA) is a system built into vehicles that informs, warns, discourages, and in some cases, prevents, a driver from exceeding the posted speed limit. While ISA has been shown to be very effective at reducing vehicle speeds and increasing safety outcomes, acceptability among the public and vehicle manufacturers is low, presenting a challenge to the widespread adoption of this technology in the U.S.(Ryan 2019).

Another element of redundancy to reinforce revised posted speed limits is traffic enforcement, as a mechanism to maintain compliance and deter drivers from breaking the law. There is mixed evidence in the United States around the efficacy of traditional traffic enforcement on improving traffic safety outcomes Makowsky and Stratmann 2011), and a recent report from the National Transportation Safety Board (NTSB) highlighted that speed enforcement in the U.S. is hampered by its inconsistencies, lack of federal funding, and lack of modern technology adoption (National Transportation Safety Board 2017). There have been some stronger indications around the efficacy of High-Visibility Enforcement (HVE) campaigns, in which targeted, conspicuous enforcement activities are conducted in conjunction with widespread media campaigns in areas with a high risk of crashes. However, HVE efforts are similarly hampered by lack of resources.

The implementation of speed safety cameras (SSCs) would represent a lower cost, highly effective mechanism for speed enforcement to be deployed in conjunction with safe and appropriate speed limits

(Federal Highway Administration 2023). However, despite the clear safety benefits of SSCs, they currently lack legal authorization in California. Legislation to allow SSC use has come before the California legislation a number of times in recent years and has gained renewed interest as a way to reduce police bias in traffic stops and reduce potential for police-related conflict. However, concerns about SSC use remain over issues such as the equitable placement of the cameras themselves, privacy and surveillance concerns, and perceptions of these devices being used for revenue generation in the jurisdictions that employ them. In an ideal scenario, SSC technology will become legally authorized in California and extensive stakeholder engagement can address many of these concerns as jurisdictions consider SSC implementation.

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Appendix 1: Interview Script (for California practitioners)

Introduction:

Thank you for participating in this interview today. This interview is part of research to inform a Safe System approach to setting speed limits in California. This is a project we're helping with to inform Caltrans and other key stakeholders in their roadway safety work.

The purpose of this interview is to better understand existing practice for setting speed limits, current challenges, as well as needed resources, tools and support. Your cooperation is important and valued.

The information collected in this interview will *not* be individually identifiable. Our intent is to help support statewide efforts to increase safety for all users of the State's roadways system.

I am going to start with a few questions about existing practices:

1. In your experience, what is the most notable limitation associated with the 85th percentile approach to speed limit setting? And the most notable advantage?

   2a. [CITY OR COUNTY PRACTITIONERS ONLY] Please briefly summarize your local process for changing a speed limit. I'm interested in the most common reasons that trigger an effort to consider changing the speed limit?

   2b. [STATE OR PRIVATE PRACTITIONERS ONLY] Please briefly summarize your process for changing a speed limit. I'm interested in the most common reasons that trigger an effort to consider changing the speed limit?

   >>> Want to make sure that they aren't speaking only to special zones.

Let's turn to your thoughts on recent legislation and how it affects your speed limit work:

3. Are you familiar with ("Pedestrians Killed in Fatal Crashes - California, 2012-2021" 2023) (passed last year / in 2021) and Assembly Bill-1938 (passed just a few months ago)? What do you expect will be the biggest impact of these legislative changes on your speed setting work?

   >>> If not familiar, interviewer provides background

   >>> If needed, can probe more deeply with one of the following questions: What critical pieces of information may change as you consider speed limit changes?

4. Were speed limit setting limitations addressed by AB-43 and AB-1938? If yes, how? If no, what limitations still exist?

I'd love to hear your ideas for the future:

5. Briefly, has your jurisdiction started to make any changes - or are you considering changes - to speed limit setting practices following AB-43 and AB-1938?

6. If you could help your jurisdiction change how speed limits are set in your area, what are possibilities that you would explore? Tell me more…

    >>>> *If nothing comes up, encourage answer:* Feel free to share, even if it is an idea for a pilot program… or something in another jurisdiction. For example, some jurisdictions are exploring 20 mph speed zones outside school zones and business activity districts. Are these or other changes something that your community has considered? If so, would this legislation help? What are barriers to changes you'd consider?

I have a few questions about the Safe System approach and speed limit efforts

7. Do you consider yourself familiar with the Safe System approach? If so, how can the Safe System approach support speed limit efforts in your area?

    >>>>*If relevant to interviewee:* What support do you need to implement the Safe System approach related to managing speeds for safety? (Examples include technical support, education, professional development, etc.)

8a. [CITY OR COUNTY PRACTIONERS ONLY] What else would you like CalTrans to know about challenges to setting speed limits in your area?

8b. [STATE OR PRIVATE PRACTITIONERS ONLY] What else would you like us to know about challenges to setting speed limits in your area?

We appreciate your time and feedback. We are asking these questions of others working in California and in other states and on national efforts. We hope to be able to share more with you when the research is finished, in about six months. In the meantime, please feel free to email me if you have further ideas.

Appendix 2: Survey Instrument (for non-California practitioners)

Safe System Approach to Setting Speed Limits in California

Thank you for participating in this survey today. It is part of research to inform a Safe System Approach to setting speed limits in California.

The purpose of this survey is to gain a better understanding of existing practice for setting speed limits, current challenges, and needed resources, tools and support. Your cooperation is important and valued. The information collected will not be individually identifiable and will be used to develop a data-driven analysis that will lay the foundation for implementing the Safe System Approach in the State. Our intent is to help support statewide efforts to increase safety for all users of the State's roadway system, including motorists, bicyclists and pedestrians.

Existing Practice for Setting Speed Limits:

1. In your experience, what are the strengths of using the 85th percentile approach to speed limit setting? Please describe.

2. What are the limitations of using the 85th percentile approach to speed limit setting?

Recent Legislation and Setting Speed Limits:

This section relates to recent legislation, such as California Assembly Bill 43 and Assembly Bill 1938 that can reduce the reliance on the 85th Percentile Rule.

3. Please describe any experiences on this topic that we can learn from. What were the challenges?

4. What do you hope to see from a shift away from using the 85th percentile to set speed limits?

The Safe System Approach and Setting Speed Limits:

5. What do you think are the challenges and opportunities for using the Safe System Approach for setting speed limits?

6. Thank you for your valuable time and feedback. Is there anything else you would like to share or think is important for us to know?

7. Please provide your email if you would be available for follow-up questions.

Appendix 3: Practitioner Interview and Survey Responses

Interviews with California-based Practitioners

The summary section headers relate to the questions asked, and the topic order is based on the order questions were asked in the interviews. Where differences exist, responses from Caltrans experts ("Caltrans") are differentiated from responses from non-Caltrans experts ("non-Caltrans").

Summary of existing practices for setting speed

Ideas about the 85th percentile approach

Advantages of the 85th percentile approach:

- Agreed upon by all: it's objective, there's a set procedure that's easy to explain, and there's a "right answer," which helps it to "feel like engineering."
- Caltrans: it reflects the speed that "feels safe'" and is "comfortable for the majority of drivers."

Disadvantages of the 85th percentile approach:

- Caltrans: one respondent expressed that there were no disadvantages to this approach and that it was "not deficient." The other two respondents noted that the 85th percentile cannot be "the only criteria" and that the speed that drivers perceive as safe "may not be a safe speed for others using the facility, especially in urban settings where the volume of pedestrians and bicyclists is high."
- Non-Caltrans: the approach is not appropriate in most circumstances, especially in urban settings, as it is not aligned with safety goals. It is problematic to allow drivers to "vote" on the speed they would like to go, which is subjective and not sensitive to other considerations like the presence and safety of bicyclists and pedestrians.
    - One respondent noted: it remains a problem that (even with AB 43), the use of a percentile-based approach as a basis for speed limit setting creates a "hard floor" for a speed limit, even if safety concerns would dictate otherwise.
    - There was general consensus that the speed limit should be such that if someone driving makes a mistake, it's not a fatal one for themselves or other people using the road.

Current process for setting speed limits

- All respondents: to set speed limits, cities, counties and the state follow the process outlined in the CA Manual for Setting Speed Limits and the CA MUTCD. This requires an engineering and traffic survey (E&TS).

- One Caltrans expert and most non-Caltrans experts: traffic studies to establish speed percentiles are difficult to achieve in urban areas because it is "hard to find a location where the traffic is not affected by a signal" and meet the requirement that the E&TS captures free-flowing traffic.

- One non-Caltrans expert noted that the requirement for the E&TS to capture free-flowing traffic and do so in daylight hours and non-inclement weather conditions may bias toward documenting faster speeds in urban areas because the E&TS forces recording of the absolute fastest speeds in the entire area, not what is typical. Another non-Caltrans expert cited as a limitation of the speed survey that it is conducted for a very limited point in time and may not represent typical conditions.

Current process for changing speed limits

- Caltrans: the most common trigger for a speed limit change is a request from a local entity who wants a speed limit change due to a new land use (e.g., mall or senior center). Others noted triggers were changes to the roadway geometry (including installation of traffic calming elements), crash history, or expiration of the E&TS.

- Non-Caltrans: while sometimes crash history was a factor, the most common trigger for a speed limit change/update is the expiration of the E&TS (will be improved with AB 43).

    - One CA county estimated that they do about 60 speed surveys per year and that by using the 85th percentile approach, speed limits increased 20% of the time and remained the same 80% of the time.

    - The burden imposed by the requirement to conduct a regular E&TS was significant for non-Caltrans experts, who cited the high number of roadway miles in their jurisdictions and the challenge to ensure every mile is covered so the E&TS doesn't expire anywhere.

The effect of recent legislation on speed limit work

Expected impacts of AB 43 (2021) and AB 1938 (2022)

- Agreed upon by all: extending the maximum validity of the E&TS from 10 to 14 years will reduce burden on practitioners without compromising safety. Additionally, the greater flexibility for local jurisdictions to consider safety and context was seen as a benefit.

- Caltrans: reported that very few impacts would be felt at the state level.

- Non-Caltrans: the changes in AB 43 and AB 1938 aren't perfect, as any process that starts with the 85th percentile will be inherently flawed. These bills will allow flexibility to help local jurisdictions "get as close to the right answer as possible."

- Engineers said they could use AB 43 to address speed creep. It allows the retention of the prior speed limit if there have been no changes in the character of the street (e.g., lane addition).
- Another improvement is the ability to designate a default speed limit of 20 mph in business districts, which is a speed that is tied to improved safety.
- The ability to consider context (i.e., safety and the presence of pedestrians and bicyclists) in making adjustments to speed limits was viewed as a step in the right direction.

Do limitations still exist; if so, what?

- Non-Caltrans experts and one Caltrans expert: the biggest limitation cited is that the State exempted themselves from AB 43.
  - Non-Caltrans: expressed frustration that the important safety changes allowed by the legislation would not be implemented on some of the most high-injury roads within their geographic area.
  - Also noted was the issue that having two separate systems (one for state highways, one for all other roadways) was problematic because of lack of consistency (drivers don't know what is a state highway and what isn't).
- Caltrans: one respondent noted concerns that reductions in speed limits may allow cities to create speed traps.
- Non-Caltrans: the 5 mph reduction allowed for safety and vulnerable users that was outlined in AB 43 will not take effect until June 2024 (the date when the judicial council updates the system for paying infractions statewide, and AB43 and AB 1938 specify that this payment system must be up-to-date before safety-related speed limit reductions are legally allowable). One non-Caltrans expert reported that after this date, they hope to review corridors where a 5 mph reduction can be applied.
- Non-Caltrans: one respondent said that the CA MUTCD and the CVC need to change and speed limits should not be based on the 85th percentile speed, but instead on the 70% percentile speed, which they believe to be closer to the speed at which people drive in a safe manner.

Has your jurisdiction made changes to speed-limit setting practices following these bills?

- Caltrans: one respondent expressed concern that the designation of safety corridors is ambiguous.
  - If speed limits drop on roadways designated as safety corridors and drivers continue to drive at the same speed, then everyone will be going 10-15 mph over the speed limit.

    - Also concerned that local jurisdictions will ask Caltrans District offices to designate a state highway as a safety corridor, but Caltrans policy is that you cannot designate a safety corridor on the State Highway System.

- Non-Caltrans: to-date, the biggest changes that have occurred in local areas because of the legislation are:

    - Lowering of speed limits to 20 mph in certain business districts, retention of current speed limits when speed studies would have previously required they be raised, and a helpful reprioritization of staff time allowed by the change to validity of the E&TS timeline.

    - One respondent noted that their city is focused on signposting new speed limits. That respondent also noted a local news article about speed limits in business districts in a neighboring city.

The Safe System Approach and other ideas

How can the Safe System Approach support speed limit efforts?

- Caltrans: the goal of a Safe System Approach is to eliminate serious and fatal collisions, and safety is a shared responsibility. All Caltrans respondents asserted that other speed management countermeasures, like enforcement and education, should be used to increase compliance.

- Non-Caltrans: the speed limit should be such that if a driver makes a mistake, it's not a deadly mistake. One respondent said that if we actually want to take a Safe System Approach, the "measured speed of the vehicle should not be used to set the limit."

    - Ideally, we would base the speed limit on our knowledge of the design of the road and the ways people are using the street.

    - There is ongoing Safe System work on infrastructure, but there are limitations (financial, competing city regulations, state-owned roads). One respondent said that with so many miles of road in their county there is no way to rely on infrastructure changes alone.

What training would be valuable?

- Most Caltrans and non-Caltrans experts identified links between speed limits and enforcement. One said "it would help if there were enforcement or enforcement funding to accompany SLS." Others noted the desire to pilot speed safety cameras and were hopeful that legislation would allow that in the near term.

- One Caltrans and several non-Caltrans experts noted the importance of education:

- For one Caltrans respondent, this included education to the public that the speed limit is actually the maximum speed, not a suggested speed. This respondent also hoped for more education to the public about the relationship between speed and both the "number of collisions and seriousness of collisions."
- Several non-Caltrans experts hoped for formal training to educate jurisdictions in California about the new changes to the SLS procedures. One suggested offering an advanced class for those who are really interested in implementing more of the flexibilities allowed under AB 43 and AB 1938.

(For city or county practitioners): What else would you like Caltrans to know?

- Many respondents stated a desire for greater flexibility to set lower default speed limits (beyond those allowed in business districts in AB 43) based on context.
- One respondent said that they would like Caltrans to be educated about the state highways in cities and counties and noted that many crashes are on state-owned roads.
- Several respondents noted that it would be preferable to have speeds set at lower limits across the entire state (e.g., 25 mph for residential streets), which would lead to greater consistency between cities and counties.
- One respondent said that they would like to see vehicles be incapable of going faster than the speed limit.

(For private or State practitioners): What else would you like us to know?

- Caltrans: there were are a wide range of summary thoughts shared:
  - One respondent reiterated that the current system is safe because drivers can choose a safe and reasonable speed; this respondent worries that lowering speed limits might be unsafe and that what is needed is to explain the 85th percentile approach more clearly to the public.
  - Another respondent sees the tension between different roadway users: drivers vs. bicyclists and pedestrians, local community vs. commuters, etc. and that SLS is a balancing act between all these parties.
- Non-Caltrans: changes to speed limits do have an impact on speed, and there will be a "substantial benefit [to safety] if there is 2-3% drop in speed."

Survey Responses from non-California Practitioners

The summary section headers relate to the questions asked, and the topic order is based on the order questions were asked in the survey instrument.

Reflections on the 85th Percentile Approach to Speed-Limit Setting

Advantages of the 85th percentile approach:

- Two of the four respondents expressed the view that there was absolutely no upside whatsoever to using the 85th percentile approach to speed limit setting, and that it is an outdated process that is unsupported by current knowledge and is out of line with a Safe System Approach.
- Another respondent described the 85th percentile approach as a great tool for understanding current conditions but not a good tool to set speed limits.
- One survey respondent indicated that the 85th percentile approach is only useful for setting speeds on limited access facilities.

Disadvantages of the 85th percentile approach:

- One respondent noted that the approach allows drivers to "vote" on speeds and "when drivers are responsible for setting speed limits, especially when road designs encourage traveling at a high speed, they will always choose to drive faster than is safe for themselves and especially for other road users (pedestrians, bicyclists, etc.)"
- Several respondents highlighted that an 85th percentile approach does not account for context, does not "prioritize safety/accessibility for non-vehicular use," and ignores the principle that speed limits should be set to minimize injury.
- Several respondents underscored that the 85th percentile approach maintains the status quo. One respondent summarized by saying that the 85th percentile "tells us where we are but not where we want to go," which should be toward safety.

Recent California Legislation Affecting Speed Limit Work

Reflections on AB 43 and AB1938

- Only one respondent provided a response, which was to generally summarize their understanding that it will "allow local entities greater freedom in setting speed limits."

Hopes for a Shift Away from Using the 85th Percentile Approach

- One respondent hoped that the legislation would help "promote public safety for all users," and another respondent hoped that the legislation would help California to "create the environment that [they] hope to see rather than being forced to operate within the current environment."
- One respondent highlighted that "research shows that when a context-sensitive approach is used to set speed limits at safe speeds on urban streets, both speeds and crashes decline." And

that if “the goal is to improve safety, there is no research to suggest that lower speed limits do anything but that.”

Challenges and Opportunities of the Safe System Approach

- One respondent said, “The opportunity is to eliminate deaths and serious injuries on our roads. The challenge is in educating the public and elected officials about why setting speed limits based on injury minimization is the only moral and ethical approach.”

- Another respondent stated, “For urban streets, allowing the Safe System Approach (SSA) to drive SLS practice is an obvious and important strategy for improving safety. The SSA places the safety onus on system designers, operators, and managers, rather than relying on humans to avoid a basic part of life: human error. An SSA for SLS removes the responsibility for selecting a speed from road users, and instead gives this responsibility to the engineers who design and manage the road.”