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MTI MINETA TRANSPORTATION INSTITUTE

A Holistic Inquiry of Intelligent Speed-Assist Technology: Safety Impacts, Technology Implementation, and Challenges

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16. Abstract
Speeding is a leading contributor to roadway fatalities in the United States, and California consistently ranks among states with the highest number of speed-related crashes. Intelligent Speed Assistance (ISA) technology has emerged as a solution aimed at mitigating this issue by notifying drivers of speed limits and, in some cases, intervening and lowering the speed to the posted speed limit. This work presents a comprehensive investigation into ISA system safety benefits, implementation challenges, and public perception, with a focus on California drivers. This study utilized a multi-method approach. A literature review explores the history, regulatory barriers, and international trails of ISA systems. A large-scale quantitative analysis was conducted on over two million consumer complaints and nearly 300,000 recall records from the National Highway Traffic Safety Administration. Filtering for ISA-related issues revealed over 100,000 relevant complaints and 6,000 related recalls, uncovering recurring themes including system malfunctions, override limitations, sensor and mapping errors, and unintended acceleration. An original survey of 286 licensed California drivers was administered to assess public awareness, behavioral tendencies, and attitudes towards ISA technology. While a majority of participants acknowledged the potential safety benefits of ISA, many expressed concerns regarding the loss of driver autonomy, system reliability, and data privacy. Drivers favored advisory or supportive ISA systems that provide feedback without fully controlling vehicle speed. The finding suggests that while ISA systems are well-positioned to reduce speeding and enhance road safety, their success hinges on thoughtful design, user trust, and supportive policy. As California and other states consider broader implementation, aligning driver preferences with technological capabilities and regulatory frameworks will be essential to using ISA to improve safety.

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Executive Summary

Speeding remains one of the primary causes of traffic fatalities in the United States, and California consistently ranks among the top states in speed-related deaths. Intelligent Speed Assistance (ISA) offers a promising technological solution by informing drivers of posted speed limits and, in some cases, actively limiting vehicle speed. This work presents a holistic analysis of ISA technology, assessing its safety benefits, implementation challenges, and public perception, with a focus on California drivers.

A three-step methodology was adopted, as follows: (1) a literature review of international case studies, regulatory environments, and technological developments; (2) quantitative analysis of over two million consumer complaints and nearly 300,000 vehicle recalls from the NHTSA; and (3) an original driver survey. The filtered analysis identified more than 100,000 complaints and 6,000 recalls involving ISA-relevant issues such as unintended acceleration, sensor errors, throttle control failures, and override difficulties.

The survey gathered 286 responses from licensed California drivers. Results showed that while most participants recognized the potential safety benefits of ISA technology, many were concerned about system reliability, loss of autonomy, and data privacy. Advisory and supportive systems that allow driver override were strongly preferred over fully automated interventions.

The study concludes that successful ISA deployment will require real-time speed-limit databases, user-centered system designs, robust override mechanisms, and transparent data governance. Recommendations include piloting ISA in high-risk corridors, offering incentives to encourage adoption, and integrating ISA within broader vehicle safety frameworks.

1. Introduction

1.1 Background and Motivation

Speeding is a significant factor contributing to road traffic fatalities worldwide. According to the World Health Organization (WHO, 2023), speeding is responsible for approximately one-third of all fatal road traffic crashes (Speeding | NHTSA; Social Determinants of Health (SDH)). Especially in the United States, speeding-related fatalities are a major concern, with the National Highway Safety Administration (NHTSA) reporting an increase of 8% in speed-related fatalities between 2020 and 2021. In 2021 alone, 12,330 people were killed, representing 29% of all traffic fatalities. Studies have consistently shown that higher speeds increase both the likelihood and severity of crashes (De Vos et al., 2023; Reagan & Cicchino, 2025).

Focusing on California, the statistics are equally alarming. In 2021, California reported 4,258 traffic fatalities, with speeding being one of the main factors contributing to a significant portion of these deaths. The European Transport Safety Council (ETSC) suggests that there is a causal relationship between speeding and fatal crashes, inferring from the correlation that a 5% decrease in speed leads to a 30% decrease in fatal crashes (Rowe et al., 2021; Van den Berghe, 2025). These studies signify an urgent need for an effective speed management initiative to address speeding and improve road safety.

The United States needs to adequately address the predominant issue of speeding. The Governors Highway Safety Association (GHSA) noted that the concern about speeding is overshadowed by other safety concerns, such as impaired driving, despite the statistics (Newly Released Estimates Show Traffic Fatalities Reached a 16-Year High in 2021 | NHTSA). Research consistently underscores the causal relationship between speeding and increased crash severity, noting that higher speeds directly lead to more severe crashes (SWOV Fact Sheet The Relation between Speed and Crashes, 2021). The inconsistency of speed enforcement across the states only furthers the issue at hand. A report by the Insurance Institute for Highway Safety (IIHS) highlights the variations in speed-limit enforcement and the lack of automated speed enforcement technologies that contribute to the challenge of effectively managing speeding nationwide (Rowe et al., 2023).

Funding for restrictive speeding measures remains a critical barrier, with a lack of funding contributing to the problem. Evidence from the World Health Organization indicates that consistent funding in speed management has led to a significant decrease in speed-related road fatalities (Borowy, 2023; Social Determinants of Health (SDH), 2023). The European Transport Safety Council (ETSC, 2018) reported that in countries with stringent speed management policies, such as Sweden and the Netherlands, the proportion of speed-related fatalities is significantly lower (European Commission, 2021).

Intelligent Speed Assistance (ISA) systems are one measure that shows a promising technological solution. ISA represents a significant advancement in vehicular safety technology, aiming to reduce speeding-related collisions and enhance overall road safety. ISA systems provide instant response and intervention to drivers, alerting them to the speed limits and, in a more "powerful" way, reducing engine power and causing a speed reduction. This technology has shown a substantial potential to decrease incidents and severe road fatalities caused by speeding. For instance, an ISA system that actively limits vehicle speed could reduce road fatalities by up to 20% (ETSC, 2018). Similarly, a study by Carsten (Carsten, Lai, et al., 2012) points out that the implementation of ISA systems with other driver assistance systems (e.g., cruise control and collision avoidance systems) could lead to a 20% reduction in traffic fatalities. Although both studies suggest the same reduction in fatalities, it is important to note that the Carsten study includes additional safety features. This suggests that while each system contributes to the overall safety improvement, the combined effects of multiple assistance systems may not lead to a higher percentage reduction in fatalities. This could be due to diminishing returns from adding more assistance systems, where each additional feature provides incremental but not multiplicative improvements in safety. ISA implementation could mark a transformative step towards safer roads, utilizing cutting-edge technology to mitigate one of the leading reasons for traffic fatalities.

The European Union has played a pioneering role in mandating the implementation of ISA systems. By 2024, all new vehicle types in the EU are required to be equipped with ISA technology, reflecting Europe's commitment to leveraging technology for enhanced road safety. This regulation is part of an initiative to establish one of the most rigorous and stringent vehicle safety standards, which includes ISA (ETSC, 2018; De Vos et al. 2023). These adaptive systems and the urge for implementation in vehicles only further Europe's advancements in transportation engineering (ETSC, 2019).

In the United States, Senator Scott Wiener introduced Senate Bill 961, which aims to address the rising issue of speed-related fatalities by implementing more serious safety measures on vehicles. The bill mandates the installation of ISA systems in new vehicles sold or manufactured in California, setting a precedent for road safety standards. Senate Bill 961 requires all new vehicles, trucks, and buses to be equipped with ISA starting by 2032 ("Senator Wiener's First-In-Nation Bill to Require Cars to Warn Speeding Drivers Heads to the Governor"). However, this bill was vetoed by the California Governor in September 2024.

The purpose of this study is to investigate the safety impacts, implementation considerations, and challenges of ISA technology within the United States, particularly in California.

ISA systems are designed to enhance road safety by helping drivers adhere to the rules of the road, more specifically the speed limit (De Vos et al., 2023). ISA utilizes various modes of technology to gauge and detect its surroundings and communicate the speed limit to the driver; in some cases, it actively intervenes to prevent the vehicle from exceeding the limit. All in all, ISA is an in-vehicle device that warns the driver about speeding, alerts/discourages the driver from speeding, and/or prevents the driver from surpassing the speed limit. As an intelligent system that uses sensors and algorithms to make real-time decisions, ISA is equipped with various degrees of comfortability for the driver. The systems can employ different methods to determine the current speed limit, including camera-based traffic recognition, GPS-based speed maps, or a combination of both. Camera-based technology can identify traffic signs, while speed maps integrated with geolocation can determine speed limits. Some systems employ data fusion techniques, combining camera-based recognition with speed map data (De Vos et al., 2023; European Commission, 2019; Weber et al., 2020).

ISA systems incorporate various control mechanisms to help drivers adhere to speed limits. These mechanisms can be categorized into advisory, supportive, and intervening controls, each with different levels of interaction and intervention (Newsome and WSP, 2024). An open or warning system warns the driver if the posted speed limit at a specific location (based on GPS coordinates) is exceeded, leaving the choice of decreasing or increasing speed to the driver (Creef et al., 2020). ISA also incorporates a half-open system that enforces a measure in the vehicle to resist the urge to speed (gas pedal resistance), but it is still feasible for the driver to gain full control by counteracting the resistance (by pushing down harder). Lastly, a mandatory or closed (automatic) system will fully prevent the driver from surpassing the limit, and the driver cannot overrule the system (Unger and Schubert, 2019). Automatic re-enabling of ISA refers to a system design feature intended to ensure that the ISA remains active each time the vehicle is in operation—even if the driver previously deactivated it—thereby preventing the system from being permanently turned off. This topic is critical due to how this prevents the driver from disabling the ISA temporarily or permanently. Under European legislation 2019/2144 of the European Parliament, all vehicles in the EU must be equipped with an ISA system that is designed to automatically reactivate after being manually disabled, thereby ensuring that the system remains active during normal vehicle operation (European Commission: Directorate-General for Mobility and Transport et al. 2019).

1.2 Research Questions

This study seeks to explore the role, perception, and potential impact of Intelligent Speed Assistance (ISA) technology from the view of the driving public in California. The following research questions were developed to guide the study:

1. What type of issues related to speed and speed regulation are presented in existing vehicle complaints and recall records, and how frequently do they appear?

This question is addressed through the analysis of consumer complaints and recall reports from the National Highway Traffic Safety Administration (NHTSA) database, filtered to ISA-related concerns.

2. What are California drivers' levels of awareness, familiarity, and prior experience with ISA technology?

This question evaluates how much the general driving public knows about ISA and whether they have encountered the system in practice.

3. How do drivers perceive the effectiveness and reliability of ISA, particularly in terms of safety, stress, speeding, and driver confidence?

This line of inquiry investigates attitudes toward the practical implications of ISA and the behavioral impact it may have on the driver.

4. What demographic and behavioral trends can be observed among drivers who support or oppose ISA adoption?

By comparing opinions across different age groups, locations, and driving behaviors, this question aims to identify patterns in public acceptance.

5. What potential limitations or concerns do drivers report regarding the implementation of ISA systems?

This final question focuses on identifying perceived barriers or negative consequences associated with ISA usage.

1.3 Organization of the Report

This work is structured to provide a comprehensive examination of Intelligent Speed Assistance (ISA) systems, combining the results of database analysis, public perception analysis, and implementation considerations. Chapter 2 presents a literature review exploring historical developments, international case studies, and the continuous evaluation of the advanced systems. Chapter 3 details the methodology and findings from the analysis of over two million NHTSA consumer complaints and nearly 300,000 recall records, filtered to identify ISA-related issues. Chapter 4 focuses on the design, distribution, and statistical analysis of an original survey conducted among California drivers, assessing awareness, behavioral impacts, and public opinion towards ISA technology. Chapter 5 outlines strategic recommendations for policymakers, manufactures, and researchers, emphasizing actionable steps to support safe and equitable deployment. Chapter 6 concludes the study with a synthesis of key findings and the broader consequences of ISA integration in the U.S. Chapter 7 discusses future research to further advance ISA technology and implementation strategies.

2. Literature Review

2.1 Introduction

The concept of Intelligent Speed Assistance (ISA) has advanced significantly since its introduction in the late 20th century (Table 1). At the beginning, ISA systems were developed as an initiative to improve road safety by reducing speed-related fatalities. The first major trial began in the 1990s, highlighting the work conducted in the Netherlands and Sweden and showing the potential of ISA to not only improve compliance with speed limits, but also to become a positive influence on driver behavior (Blum et al., 2012).

The early 2000s was a monumental time for ISA technology, as various countries and research bodies conducted trials to evaluate its feasibility. The Netherlands and Sweden were among the first to conduct large-scale trials, starting around 2001. These trials, which utilized both GPS-based and road-sign recognition systems, showed promising results in improving speed compliance and reducing fatality risks. Field tests, such as those conducted under the European Union research projects PROSPER and SARTRE, explored the behavior of drivers under different types of ISA. These early studies pointed out the importance of balance between driver autonomy and automated control (Blum et al., 2012). During the years 2006–2010, ISA started to transition from the testing phase to real-world applications. A notable example is the large-scale deployment of ISA systems in several European cities as part of pilot programs aimed at improving urban road safety. Private companies began expanding ISA-equipped vehicles into company fleets, as indicated in Table 1. Between 2015 and 2020, there was a significant regulatory push for ISA implementation. The European Union took the initiative in 2019; legislation was passed making ISA a mandatory feature in all new cars starting in 2022. Since 2020, ISA technology has become a topic of conversation, with many car manufacturers integrating systems into vehicles.

Table 1. Timeline of Development and Adoption of ISA

2.2 Overview of Early Research

The development of ISA technology has been a gradual process, and it can be seen as a milestone in automotive technology. The initial concept of speed assistance goes back to the late 20th century, with the focus being on advisory systems. Early research indicated that the usage of ISA as an advisory system could lead to improved compliance with speed limits and further the initiation of road safety (Lai, Chorlton, & Carsten, 2012). Over time, technological advancements have allowed for more sophisticated and developed ISA systems to be seamlessly compatible with vehicle control mechanisms.

Recent developments have focused on enhancing the accuracy and reliability of ISA systems. The use of high-definition GPS speed maps, real-time traffic data, and advanced machine learning algorithms has significantly improved the performance of ISA.

2.3 Safety Impacts

Several studies have demonstrated the positive safety impacts of ISA. A study conducted in 2005 by Carsen and Tate proved that ISA could reduce the number of speeding-related fatalities by 30% (Peiris et al., 2021; Carsten & Tate, 2005). Another long-term study conducted in 1999–2002 concluded that drivers who used ISA were less likely to engage in speeding or other risky driving behaviors, directly correlating to a reduction in traffic incidents (Lai, Hjälmdahl, et al., 2009; Biding & Lind, 2002).

The European Union is already implementing ISA systems in all vehicles as part of a bigger road safety initiative. The EU implemented a policy mandating the integration of ISA technology in all new vehicles sold. This policy was adopted as part of the EU's General Safety Regulation, which aims to enhance road safety and reduce traffic-related fatalities. Effective in 2022, the regulation requires all new car models to be equipped with ISA systems that alert drivers when they exceed the speed limit and, in some cases, actively slow down the vehicle to comply with speed regulations (European Parliament, 2019). Having started to implement ISA into vehicles in 2020, the EU has seen a 15% decrease in road fatalities (EU, 2020).

Long-term trials in the UK and Sweden to study the effects of prolonged exposure to ISA concluded that, over time, the system adapts to the driver's behavior (Lai, 2010). One aspect highlighted by the study is the importance of ISA systems adapting to the driver's behavior and driving context. For example, ISA could adjust the sensitivity of speed alerts based on a driver's consistent driving patterns—such as frequent driving on rural roads where speed limits may vary unpredictably—or provide more frequent reminders if a driver tends to exceed speed limits by small margins. Over time, an adaptive ISA system could learn that a particular driver responds better to visual alerts rather than audible ones and adjust its feedback method accordingly. Such personalization may enhance driver acceptance and reduce annoyance or alert fatigue, ultimately improving system effectiveness. The study concluded that ISA systems need to account for outside variables such as driver characteristics and environment to ensure efficiency.

The European Union mandated that all new vehicles are to be equipped with ISA by 2024, as a part of a bigger safer road initiative. This initiative shows significant promise, highlighting the potential to reduce speeding incidents by 30% and road fatalities by 20%, thereby improving road safety (ETSC, 2017). While Carten's study included ISA alongside other systems such as cruise control and collision avoidance, the similar fatality reduction figure reported by ETSC may be attributed to overlapping safety effects, as these technologies target many of the same speeding-related risk factors. A study notes that approximately 60–75% of drivers would be receptive to the system integration within their vehicle within the USA (Reagan and Cicchino, 2025). In areas where speeding is a common issue, ISA tends to have higher public acceptance. A UK study predicted that warning-based ISA systems could reduce fatalities by up to 33% in urban areas (Lai, Carsten, & Tate, 2012).

2.4 Driver Behavior and Acceptance

The literature review highlights ISA's effectiveness in improving driver behavior and reducing fatalities (Warner & Åberg, 2008). Understanding the factors influencing ISA acceptance is crucial, as preferences vary by demographic factors and ISA system types (Molin, & Brookhuis, 2007). Studies show that drivers prefer mandatory ISA for offenders and professionals, but voluntary ISA for themselves (Molin, & Brookhuis, 2007). A study by the IIHS found a 60% acceptance rate if vehicles provided warnings for exceeding speed limits (Reagan & Cicchino, 2025). Device characteristics and contextual issues impact ISA efficacy (Vlassenroot et al., 2007). In high-risk scenarios, ISA significantly impacts behavior, and its control level elicits varied reactions from drivers (Özkan et al., 2024). The study utilizes the Theory of Planned Behavior (TPB) to predict intentions to turn ISA on and override ISA when turned on among 554 drivers who never had experience with vehicles equipped with the system, indicating that 76% of drivers are willing to turn ISA on, while 59% are likely to override the system (Özkan et al., 2024).

Driver acceptance is key for seamless ISA integration. Drivers generally appreciate ISA assistance without feeling restricted (Brookhuis & De Waard, 1999). Advisory ISA systems effectively prevent "accidental" speeding (Creef et al., 2020). Social acceptance is essential; drivers acknowledge the safety benefits of ISA systems but resist them due to control and autonomy concerns (Carsten & Tate, 2005). Communicating with drivers and informing the public is crucial for widespread acceptance. User-centered ISA design enhances acceptance by tailoring the system to driver characteristics and reactions (Jiménez et al., 2021).

The implementation of ISA can be significantly furthered through financial incentives. One study suggests that the use of voluntary ISA can be encouraged through financial incentives, with purchase subsidies being preferred over annual tax reductions (Molin & Brookhuis, 2007). Moreover, drivers with repeated speeding offenses and professional drivers are more receptive to mandatory ISA, while for an everyday driver, voluntary ISA with financial incentives is deemed a favored persuasion tactic.

European drivers have shown varied reactions to the implementation of ISA systems, influenced by personal driving habits, perceptions of safety, and acceptance of technology. Studies have shown that the acceptance of ISA is crucial for its successful implementation (van der Pas et al., 2018). For example, habitual speeding offenders favor mandatory ISA, while regular drivers prefer voluntary ISA with financial incentives.

2.5 Implementation Considerations

Implementing ISA is a key factor in the acceptance of technology due to the challenges it presents, including technical, regulatory, and social barriers. Technical challenges include the accuracy and reliability of the GPS speed map, which the system within the vehicles follows. Another aspect involves the seamless integration of technology within the vehicle. To ensure the reliability of the system, policies, regulations, bills, and mandates for ISA adoption must be enacted, varying based on location (Reagan & Cicchino, 2025).

As technology undergoes updates, so do ISA systems. Significant advancements in recent years, powered by data collected through studies, allow for improvements in data accuracy, sensor integration, and user interface design. These enhancements have increased the functionality and reliability of ISA systems, making them more driver friendly. The most notable technological update includes the implementation of real-time traffic data, allowing ISA systems to dynamically (automatically) adjust to the speed limit based on current road conditions, improving both safety and efficiency. A recent study found that integrating real-time data reduces the risk of fatalities in congested urban areas by providing drivers with timely speed adjustments and alerts (Harri, 2023).

Sensor technology plays a pivotal role in enhancing the effectiveness of ISA systems, ensuring better accuracy and adaptability in various driving conditions. Sensors are a crucial part of ISA systems and updating sensor technology correlates with improvements. ISA utilizes high-definition cameras to accurately detect and recognize speed limit signs even in varying weather conditions. According to one study, the implementation of advanced sensors has enhanced the accuracy of speed limit detection by 25%, significantly decreasing instances of false readings and system errors (Weber et al., 2020). Machine learning algorithm implementation has allowed ISA to adapt to driver behavior and tendencies. Being able to predict the driver's reactions allows the system to adapt and make proactive decisions, increasing overall safety. One study indicates that ISA systems driven by machine learning can reduce speeding incidents by up to 30% by predicting and mitigating risky driving behaviors (Singh et al., 2022).

2.6 Real-Life Trials

The real-life trial of ISA provides great insight into the everyday challenges and benefits. Various real-life studies are conducted worldwide researching the benefits of ISA in reducing speeding and increasing road safety.

2.6.1 Swedish Trials

In Sweden, large-scale ISA trials were conducted between 1999 and 2002, being a comprehensive study involving numerous vehicles across urban areas in Sweden, including Stockholm and Lund. This trial equipped around 4,500 vehicles with ISA devices designed to monitor and control vehicle speeds, providing real-time feedback to drivers to ensure compliance with speed limits (Swedish National Road Administration, 2002). The findings from this extensive trial demonstrated that ISA systems significantly improved speed limit adherence, leading to a reduction in speeding-related fatalities. The results showed that vehicles equipped with ISA maintained appropriate speeds more consistently compared to those without the system. Additionally, the study highlighted positive driver acceptance and the feasibility of integrating ISA technology into urban traffic environments (OEI and POLAK). Studies such as large-scale ISA trials in Sweden yield results indicating better speed compliance and reduction of traffic fatalities. Sweden reports a notable increase in road safety due to ISA, along with drivers' acknowledgment of system benefits (European Commission, 2023).

2.6.2 Belgian Trials

The Belgian ISA trial was one of the largest trials in Europe, involving over 1,000 vehicles equipped with ISA technology. The trial results indicated a notable reduction in speeding violations, with a 40% increase in compliance rates (Van den Berghe, 2006). The Belgian trial emphasized the potential of ISA systems to significantly enhance road safety through improved speed compliance, along with reporting positive driving experiences (Van den Berghe, 2006). Many participants expressed enticement towards ISA becoming a mandatory system (Van den Berghe, 2006).

2.6.3 UK Trials

Throughout the UK, numerous studies were conducted to assess the effectiveness of ISA in alternative settings. The Speed Limit Adherence and Safety Trail (SLAST) showed signs that indicated a reduction of 20% in road traffic fatalities (Carsten et al., 2020). The SLAST trial demonstrated that ISA, when integrated with real-time data and tailored to user needs, can substantially reduce accident rates, underscoring the importance of real-time data in enhancing road safety (Carsten et al., 2020). The trial also assessed the systems interface, pointing towards a more advanced "user-friendly" interface. Poorly designed systems can annoy, confuse, or distract drivers, potentially leading to the opposite of the intended safety improvements (De Vos et al., 2023).

2.6.4 Australian Trials

Australia evaluated the impact of ISA on driver behavior and road safety. The trials implemented ISA systems and monitored their performance throughout the year. Participants in the SafeCar project experienced reduced stress and improved compliance with speed limits, highlighting the benefits of ISA and resulting in a significant reduction in speeding-related incidents. Specifically, the project found that the ISA system could reduce the amount of time drivers spent traveling 6.21 mph or more above the speed limit by up to 65%. Drivers reported a less stressful and more relaxing driving experience (Regan et al., 2006).

The largest road safety technology trial ever conducted in New South Wales shows promising evidence supporting the benefits of ISA systems. The trial involved over 110 light vehicles from private and company fleets equipped with both advisory ISA and speed data recorders. To conduct a comprehensive assessment of ISA technological impact, the trial took place in real-world driving conditions (Wall et al., 2010). The system continuously monitored the driver's speeds and provided real-time feedback to drivers, alerting them when exceeding the speed limit. The use of advisory ISA systems in the trial reduced speeding in 89% of vehicles, hinting at a potential reduction in road deaths by 8.4% and injuries by 5.9% if implemented across New South Wales (Creef et al., 2011). Being a success, the trial underscored the system’s capability to enhance obedience to the speed limit and its positive acceptance rate among drivers, including continuous speeding offenders (Wall et al., 2010).

2.6.5 USA Trials

Several trials within the United States have demonstrated ISA system’s effectiveness in reducing speeding and increasing road safety. The New York City Department of Transportation conducted a pilot program implementing ISA into 50 of the city’s vehicles, including passenger cars, utility vehicles, and trucks. ISA provided significant aid in limiting speeds and decreasing urgent (harsh) braking incidents (NYC DOT, 2022). During the initial five weeks of implementation, the override button—which temporarily disables the ISA system—was used approximately 600 times, indicating the initial adjustment period for drivers. The program expanded to 7,500 fleet vehicles over the next 3–4 years. Another trial conducted in Michigan tested the Active Accelerator Pedal (AAP) systems among young drivers. Like ISA, with AAP, the gas pedal gains resistance as drivers surpass the posted speed limit, resulting in less speeding and more driver awareness of speed limits (Blomberg et al., 2011). This study also examined young drivers (18–24 years old), a demographic known for higher rates of speeding and crash involvement, to assess the effectiveness of the Active Accelerator Pedal (AAP) system in promoting safer driving behavior. The trial included 44 participants organized into 22 matched pairs by age and gender. In each pair, one participant drove a vehicle equipped with the AAP system, while the other drove a comparable vehicle without it.

Results showed that drivers using the AAP system exhibited lower rates of speeding and demonstrated increased awareness of posted speed limits (Blomberg et al., 2011).

In California, 56 companies were authorized in 2021 to test automated vehicles on public roads. While not all conducted large-scale trials, some companies deployed extensive fleet testing across state and national routes, similar in scope to the previously discussed Wall study (D'Agostino et al., 2021; Wall et al., 2010). Participating users generally expressed positive feedback, particularly appreciating the systems' ability to maintain safe, consistent speeds.

2.6.6 International Comparison

The European Commission (EC) analyzed the results of ISA trials conducted within numerous countries, including the US, Australia, and many European nations. The study concluded that countries with higher ISA integration rates experience a reduction in traffic fatalities. The international study by the EC underscores the essential role of policy and public awareness in the successful adoption of ISA systems, emphasizing how crucial these factors are in gaining acceptance and implementing ISA effectively (European Road Safety Observatory, 2023).

3. Investigation of NHTSA's Vehicle Owner Questionnaire Database

3.1 Data Retrieval and Conversion

To better understand public concerns regarding Intelligent Speed Assistance and related speed control technologies, an in-depth analysis was conducted using The National Highway Traffic Safety Administration (NHTSA) database. The analysis focused on two primary data sources: consumer complaints and vehicle recall records. The following section displays the outlines of the process taken to retrieve the data, presenting key findings on recurring issues, regional trends, and system performance while delving into the safety concerns and user experiences with ISA.

Understanding public interaction with ISA systems requires examining large-scale, real-world data that reflects drivers' experiences. The datasets were retrieved directly from the NHTSA database and categorized as consumer complaints and recalls. Both datasets were initially provided in a text format, which was then converted to Excel sheets to facilitate the analysis. The consumer complaints dataset was comprised of 2,071,055 rows of data spanning from 1949 to 2024. This dataset included details such as vehicle make, model, year, and descriptions of the issues reported by consumers. Similarly, the recall data contained 293,690 rows of data providing insight into safety defects or regulatory non-compliance in vehicles, containing information on manufactures, specific models, and descriptions of the recalled components. Due to the large size and scope of these datasets, a structured approach to cleaning and filtering was implemented to ensure the data remained manageable and relevant.

3.1.1 Data Cleaning and Filtering

The dataset included information beyond the scope of the study, such as data for motorcycles, RVs, and commercial vehicles. An initial MATLAB script was developed to refine the datasets by excluding such "entries," keeping only passenger vehicles such as cars and pickup trucks. This script ensured that the base of the analysis was relevant to the mass civilian population, aligning with the research objectives.

Additionally, a filtering process was initiated to identify keywords that are relevant to ISA. Keywords—which included, but were not limited to, "intelligent speed assistance," "speeding," "speed control," "cruise control," and "throttle"—were used to isolate data related to speed-related complaints and recalls. Going through this process allowed for the dataset to be reduced to a manageable, relevant, and focused analysis. The complaint dataset began at 2,071,055 complaints and resulted in a manageable 100,477 complaints after filtering; the recall dataset began at 293,690 recalls and resulted in 6,003 recalls.

3.2 Consumer Complaints Analysis

Using Python and Visual Studio Code, a detailed analysis was conducted after the filtering phase. Common themes emerging from the analysis included system malfunction, sensor or mapping errors, driver override difficulty, and unintended speed control behavior. An analysis of complaints by manufacturers highlights significant discrepancies across automotive brands. Ford emerged as the manufacturer with the highest number of complaints, recording over 29,133 reports. General Motors followed with the second most complaints (21,454), followed by Chrysler (13,587), Toyota (10,047), and Honda (4,728) (Figure 1).

ISA-related complaints increased significantly over time, notably after 2000 (Figure 2). The annual complaint count rose sharply between 1995 and 2005, while consumer complaints regarding speed control spiked around 2004. Overall, recall actions began to decline after 2000, likely due to improved regulatory measures. This growth aligns with the increase in the introduction of electronic throttle and cruise control systems across vehicle fleets.

Figure 1. Top 10 Manufacturers in Complaints

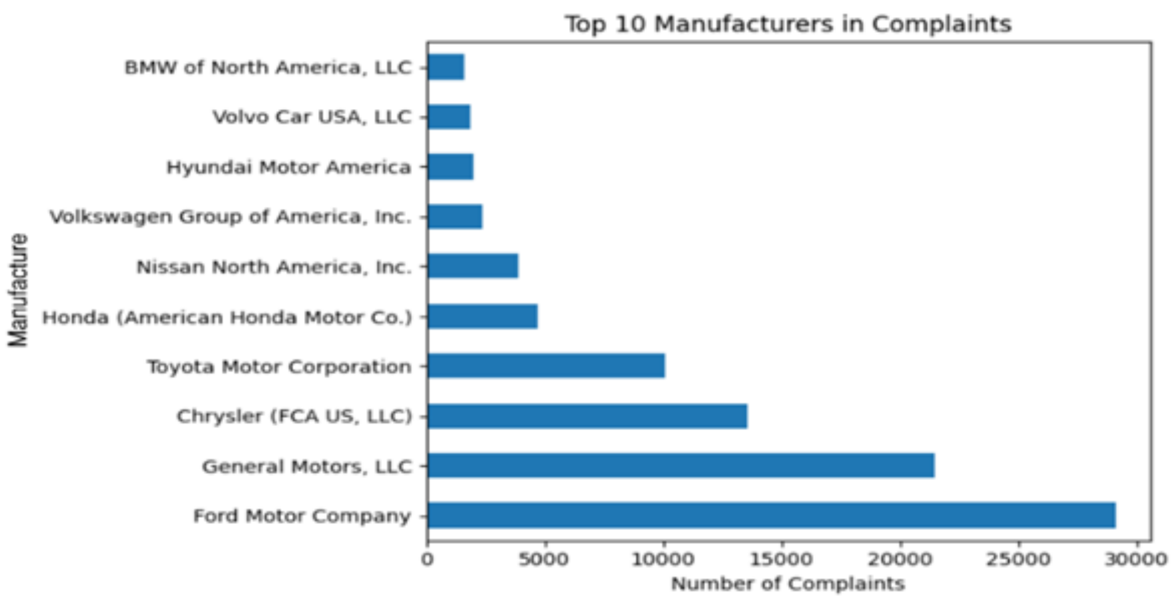
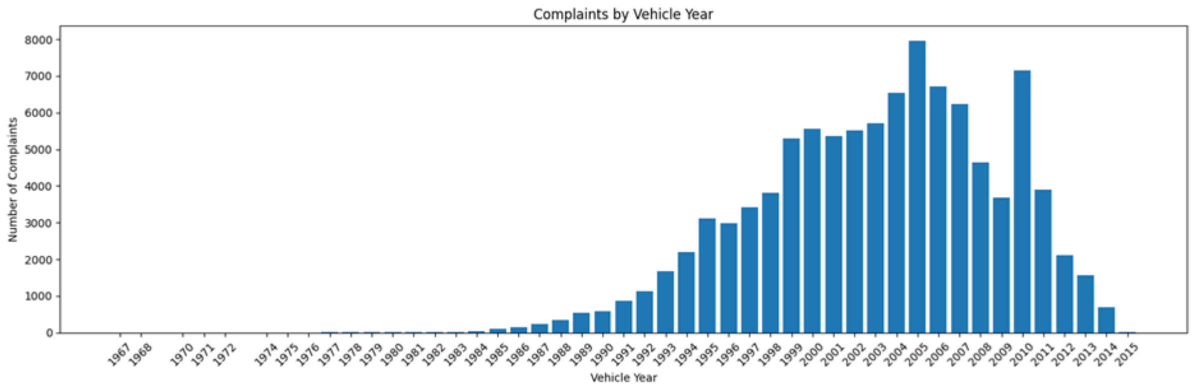
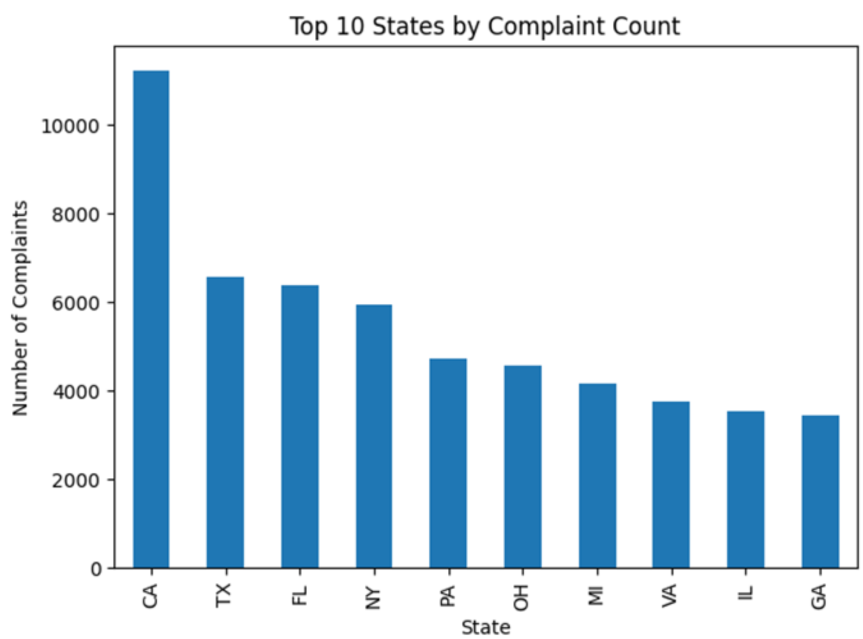


Figure 2. Number of Complaints Over the Years



The geographic distribution of the complaints shown in Figure 3 indicated a significant skew based on state. California reported the highest number of complaints (11,217), followed by Texas (6,565) and Florida (6,391). Other significant states include New York, Pennsylvania, and Ohio. These findings indicate that regional factors can play a significant role in speed-related issues. The geographic distribution suggests that certain areas may experience more frequent or severe speed-related vehicle issues, which could be due to the variations in road infrastructure, traffic density, or vehicle usage patterns. These findings highlight critical areas where ISA technology requires alterations, particularly in ensuring reliability and safety in real-world integrations.

Figure 3. Top 10 States in Complaint Data



Keyword analysis of NHTSA consumers revealed that issues related to speed control and ISA functionality were among the most reported (Figure 5). The most frequently occurring terms included "speed" (71,631 mentions), "engine" (28,923 mentions), and "brake" (27,499 mentions), suggesting widespread user concerns around unintended acceleration, loss of control, and inadequate responses to driver input. Occurrences of "brake," "cruise," and "override" further indicate problematic system interactions with driver-controlled elements. These terms reflect both operational failures and user discomfort with how vehicles manage speed dynamically, particularly in situations where automation may limit driver control. The clustering of these terms underscores public resistance regarding safety, responsiveness, and override capabilities of intelligent or semi-autonomous driving systems.

Other keywords such as "fire" (4,022 mentions) indicate a severe consequence that system failures could potentially cause. In addition, the dataset included information regarding the status of the complaint, indicating if the vehicle was involved in a crash or fire. Among the ISA-related complaints analyzed, a total of 10,606 cases involved reported crashes with 7,534 injuries and 726 fatalities documented (Figure 4). The database also contains an optional "Vehicle Towed" field; however, this field is rarely completed. Only 13 ISA-related crash records explicitly indicated "Yes" for this variable. This low figure reflects underreporting in the database rather than the real-world frequency of towing and therefore cannot be used as a reliable indicator of crash severity.

Figure 4. Total Injuries and Fatalities Reported in Complaints

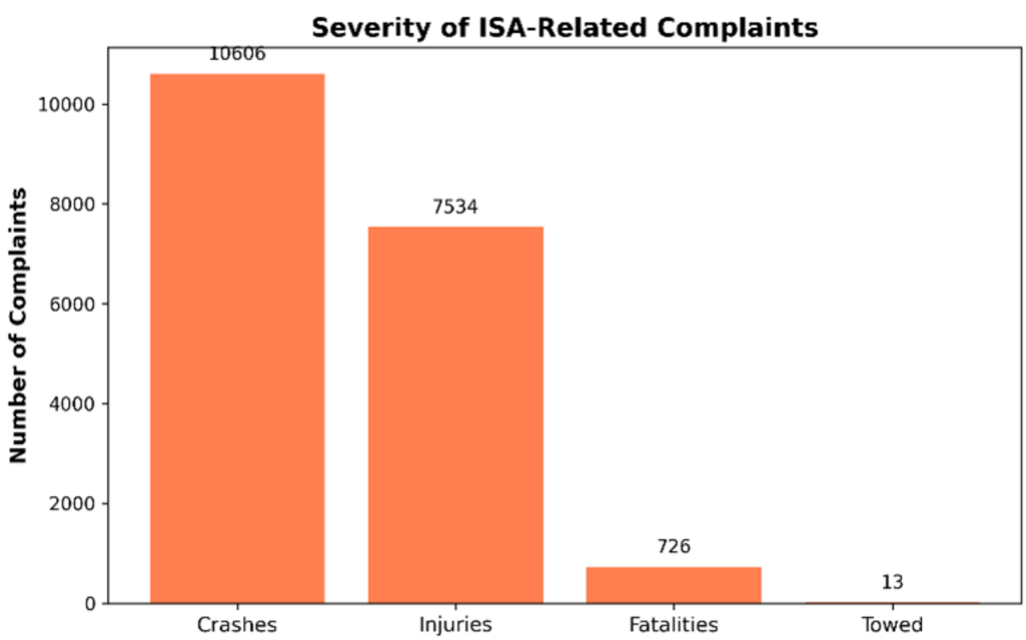
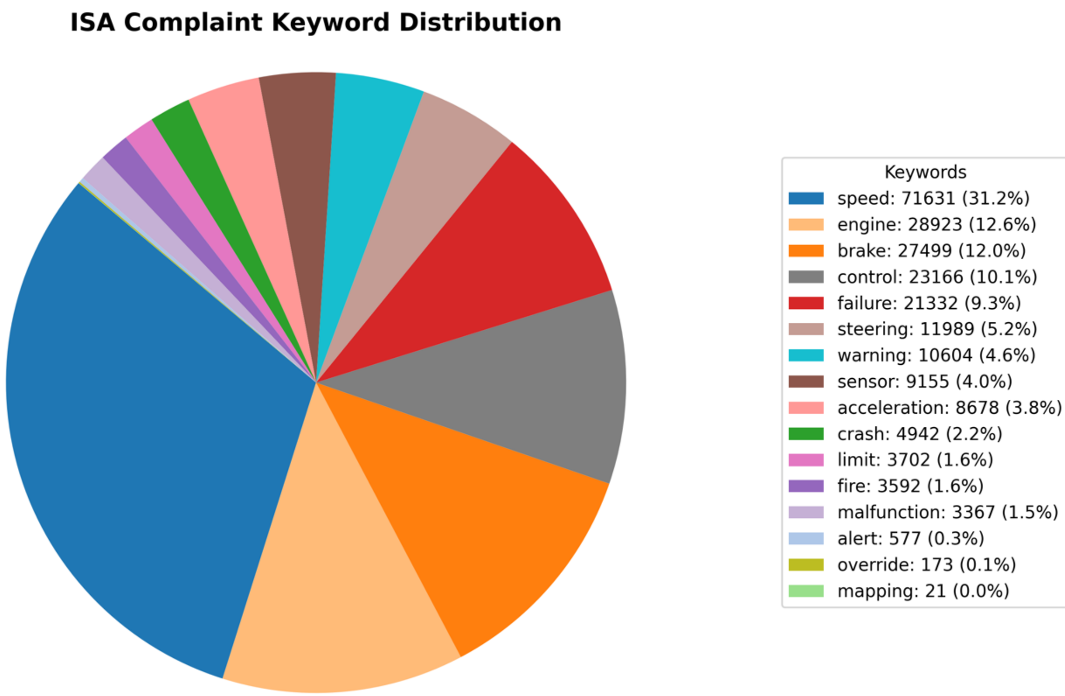
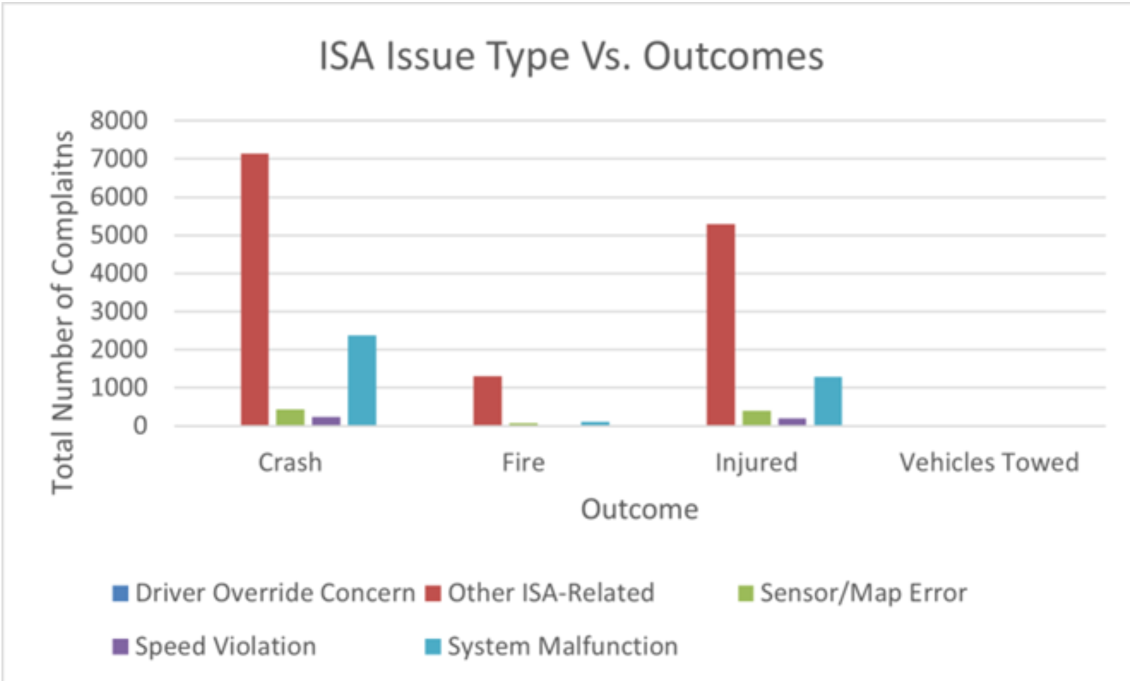


Figure 5. Complaint Keyword Frequency



The complaints were classified into five distinct categories based on failure types: System Malfunction, Sensor or Map Error, Speed Violation, Drive Override Concern, and Other-ISA Related. Seen in Figure 6, System Malfunction represented the most frequently reported issue after Other-ISA Related issues, comprising 72% of all ISA-related complaints, followed by Sensor or Map Error at 18%. Speed Violation and Drive Override Concern issues were less frequent, making up 2% together; however, these issues were significantly more likely to result in crashes or injuries.

Figure 6. ISA Issue Type vs. Outcome



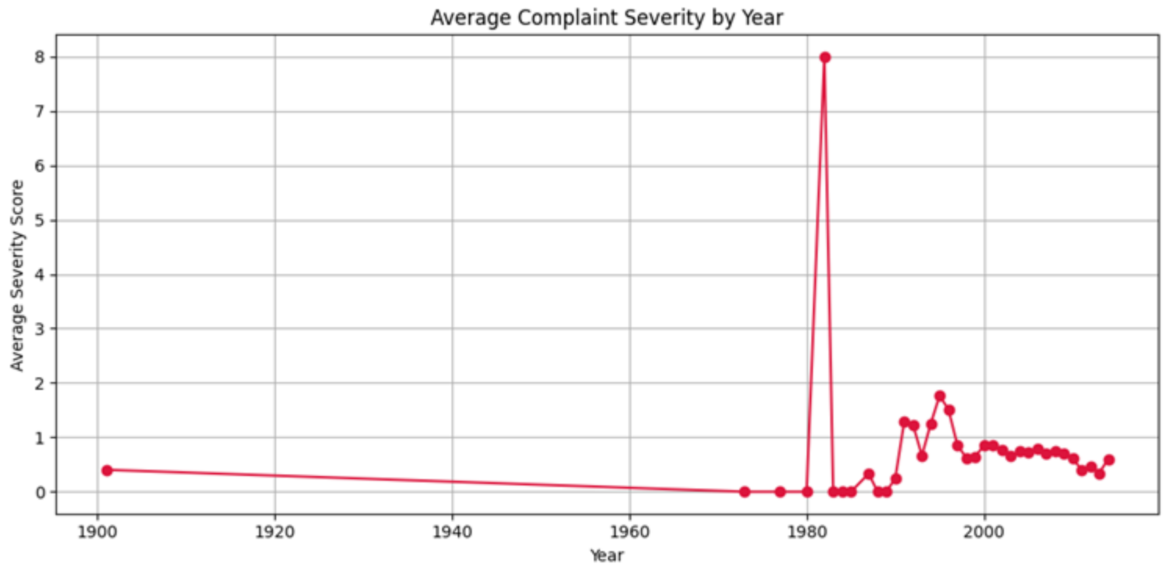
To evaluate the seriousness of ISA-related complaints, a custom severity scoring rubric was applied to the filtered NHTSA dataset. As indicated in Table 2, each complaint was scored based on the presence of key incidents: towing (2 points), crash involvement (3 points), fire (4 points), and reported injuries (5 points). This standardized scoring system allowed for a consistent comparison of complaint intensity across the dataset.

Table 2. Severity Rubic

Component	Point Value	Explanation
Vehicle Towed (Y)	2	Vehicle was towed as a result of the issue (Y = Yes)
Crash (Y)	3	Complaint includes a crash report (Y = Yes)
Fire (Y)	4	Complaint includes a fire report (Y = Yes)
Injured (>0)	5	Complaint lists one or more injuries

The severity scores ranged from 0 to 14, with the majority of the complaints scoring lower on the spectrum. When analyzed by year, the average annual severity was about 1.5–2 over the past two decades. Once these scores were computed, an analysis revealed that the average severity per year remains relatively moderate, especially in more recent decades as seen in Figure 7. From the mid-1990s onward, yearly averages typically ranged between 0.5 and 2.0. A single-year spike is visible in 1982, driven by a small but unusually high-severity complaint for that year. Following this anomaly, complaint severity levels stabilized. This suggests that while complaint volume has grown, the proportion of reports involving serious consequences has not increased in a linear fashion.

Figure 7. Average Complaints Severity by Year

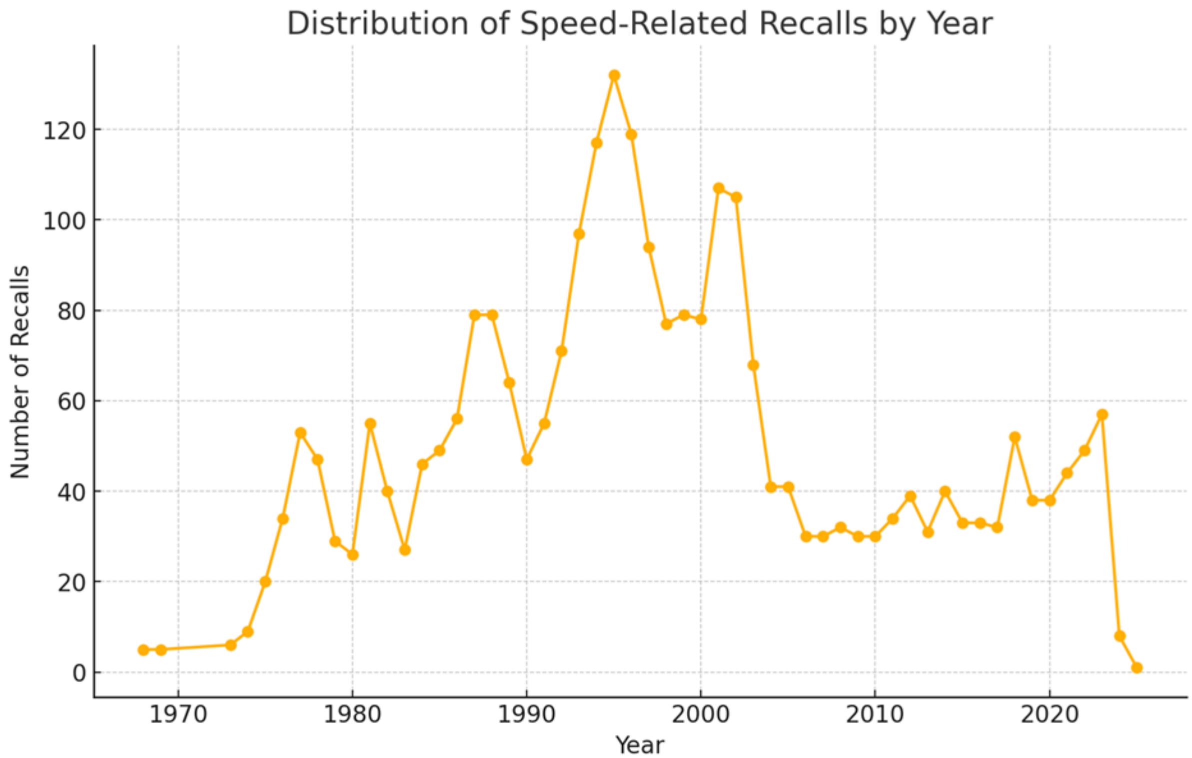


The NHTSA consumer complaint dataset provides a powerful overview of how drivers experience speed-related system failures in real-world settings. Categories such as override failure or speed regulation mistakes show clear signs of elevated risk. The presence of fire involvement, though rare, adds further weight to these concerns. Complaints with high severity scores reinforce the importance of overriding systems in ISA implementation.

3.3 Recall Data Analysis

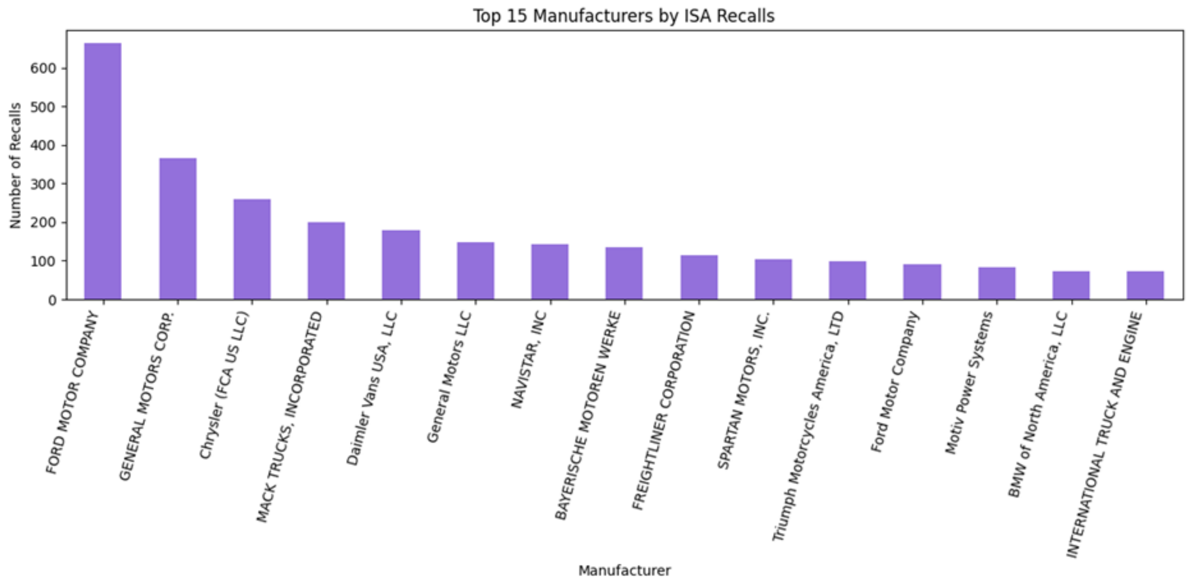
The recall dataset offered insights into the technical challenges manufacturers faced when implementing speed control systems. Key issues identified during the analysis included many of the similar concerns shared by consumer complaints such as unintended acceleration, throttle control failures, and cruise control malfunctions. Manufacturers often cite mechanical or software related defects as the cause of the problem. Common solutions that are implemented by the manufacturers include module reprogramming, safety circuit integration, and part replacements (i.e., the throttle). The recall analysis complements the consumer complaints by examining formal actions taken by manufacturers and regulators in response to verified safety concerns involving speed-related control systems. Of the 293,690 recall records analyzed, 6,003 (2.04%) were directly related to speed control systems. Figure 8 shows speed related recalls by year. The annual number of recalls steadily increased through the late 20th century, indicating heightening regulatory scrutiny and the growth in vehicle technology. The decline post-2000 could possibly reflect the success of improved safety standards and regulatory oversights.

Figure 8. Distribution of Speed-Related Recalls by Year



Recalls often address critical defects; these issues are not isolated to a single manufacturer but span across multiple brands and models, highlighting the need for industry-wide improvements in speed control technology. Of the 293,690 recall records analyzed, 6,003 (2.04%) were directly related to speed control systems. Notably, manufacturers such as the Ford Motor Company, General Motors, and Chrysler account for a significant portion of these recalls, as seen in Figure 9. The resolution methods typically involved software updates and mechanical part replacements.

Figure 9. Top 15 Manufacturers by ISA Recalls



The key focus of this analysis was identifying common defects, trends, and areas of concern. “Speed” (3,641 mentions), “engine” (1,529 mentions), “control” (2,578 mentions), and “brake” (1,066 mentions) are among the most frequent terms, as shown in Figure 10. These high-frequency keywords reflect recurring narratives involving unintended acceleration, system overheating, and failure to decelerate. Less frequent terms such as “override” and “mapping” suggest more specific ISA failure scenarios that are nonetheless essential for understanding edge-case system limitations.

Further analysis indicated a deeper breakdown of specific vehicle components frequently associated with recalls. Terms such as “brake,” “control,” and “engine” also rank highly, reflecting a number of reoccurring issues, including braking system issues, electronic stability control, and powertrain components. Such issues are often associated with large-scale recalls due to the direct impact on vehicle useability and passenger safety.

The components most frequently implicated in ISA-related recalls is “Vehicle Speed Control,” accounting for over 1,500 recalls as indicated in Figure 11. Related sub-systems such as braking systems and speed control cables also appeared frequently. This trend indicates the sensitivity of these components to malfunction, especially as vehicle speed regulations shift from mechanical to technological.

Figure 10. Keyword Frequency in Recall Data

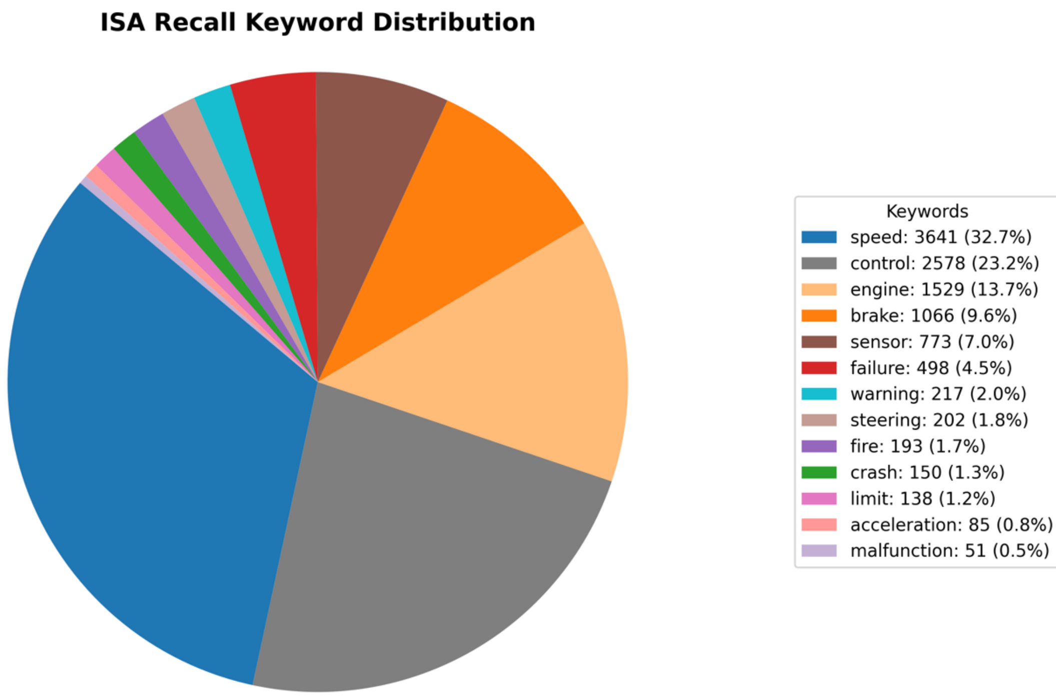
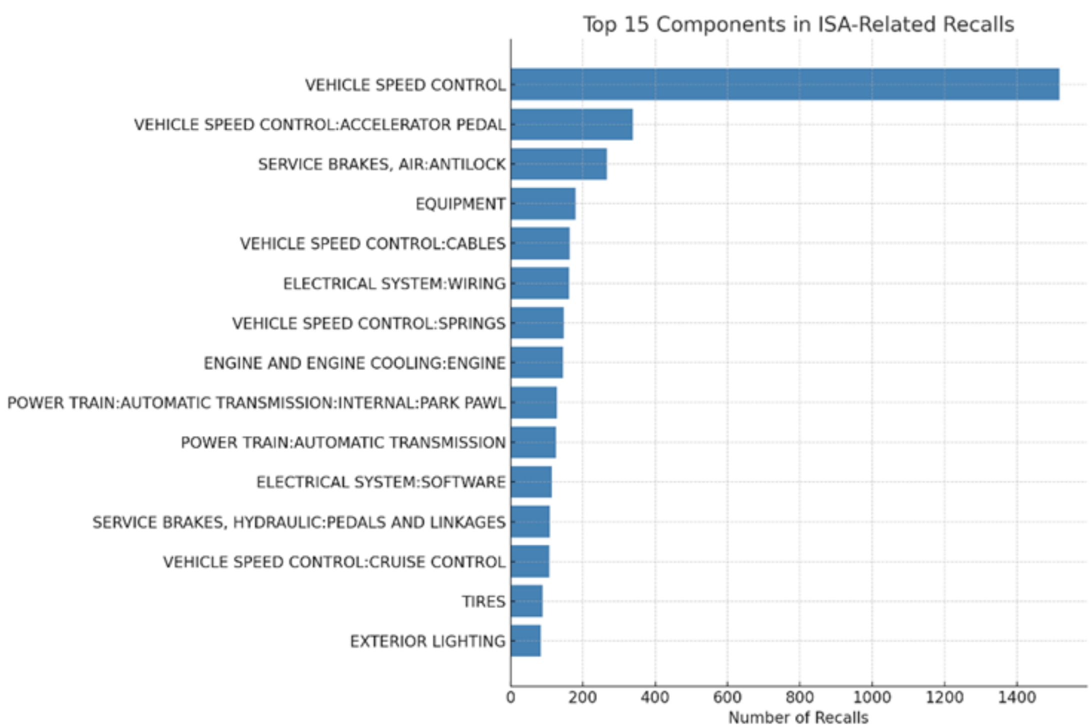
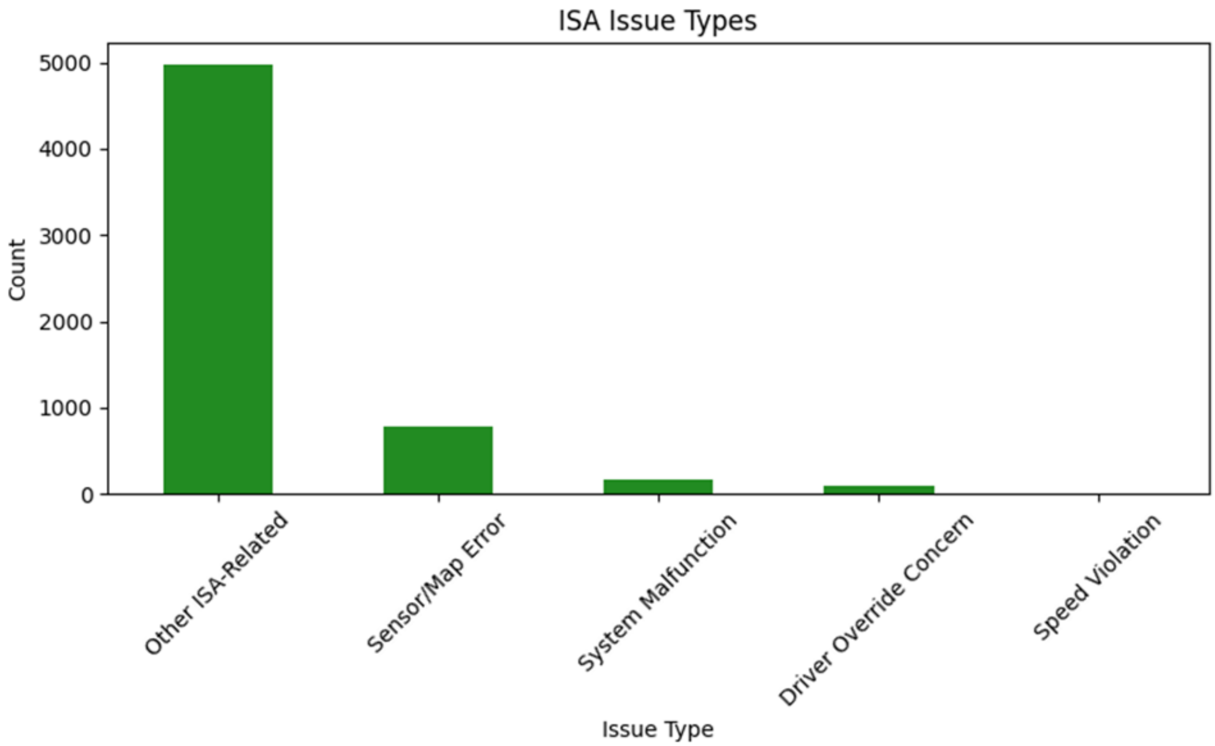


Figure 11. Top 15 Components in ISA-Related Recalls



Each recall in the filtered database was categorized by issue type using a custom classification schema developed for this research. The most prevalent category was "Other ISA-Related," capturing recalls that could not be definitively assigned to a specific failure mode but still involved speed regulation systems as seen in Figure 12. However, specific categories such as "Sensor/Map Error," "System Malfunction," and "Driver Override Concern" were represented.

Figure 12. ISA-Issue Types in Recall Database



The analysis of ISA-related NHTSA recall data reveals that speed regulation faults are not confined to isolated cases or specific manufactures but rather indicated a broad and persistent safety challenge. Over decades, thousands of vehicles have been recalled for issues directly tied to the loss of speed control, unintended acceleration, throttle failures, and brake override failures. The trends were observed across time, component category, and failure type, reinforcing the need for proactive monitoring and testing of ISA-systems.

3.4 Conclusion

The combined analysis of NHTSA's consumer complaints and recall datasets provided a comprehensive overview of the challenges ISA and speed control systems pose in modern vehicles. By examining over 2 million consumer complaints, filtered down to 100,477 ISA-relevant records, and 293,690 recalls, reduced to 6,003 ISA-related recalls, the findings underscore the concerns with the integrity, reliability, and safety of these systems overtime. Key trends emerged from the data, highlighting recurring issues such as unintended braking, throttle control failures, and cruise control malfunctions. The concerns reflected in both the consumer complaints and the recall records indicated the need for attention to address systemic issues in speed control-related technology.

From the complaint data, recurring failure types included unintended acceleration, override malfunctions, cruise control errors, and sensor/map inaccuracies. Not only are these complaints critical, but complaints involving override difficulty or speed regulation lapses had noticeably higher average severity scores than general system malfunctions. Complaints indicating fire involvement and those reporting crashes and injuries illustrate the real-world consequences of seemingly infrequent failures.

Geographically the majority of the complaints were concentrated in states such as California, Texas, and Florida, which indicated that the area's traffic conditions and infrastructure play key roles in the vehicle's performance. Similarly, the grand presence of safety related keywords such as "failure," "brake," "collision," and "fire" indicate the high stakes of ensuring system reliability. The keyword analysis uncovered the appearance of "speed," "brake," "engine," "failure," and "collision" over thousands of times, only highlighting the experience of danger and loss of control.

The recall data only repeated the findings in the consumer complaints database, which were most often related to vehicle speed control systems with over 1,500 cases related to this component. Other highly reappearing components included the accelerator pedal, braking, electric systems, and engine issues.

Analyzing the complaint and recall data demonstrated that while systems have advanced in speed control systems, there remains a critical need for testing, adaptive designs, and improving system reliability. While automotive technology continues to advance, the persistence of ISA-related failures in both complaints and recalls points to a need for improving overridable designs, in addition to better software testing. Prioritizing these persistent and recurring themes can ensure that ISA technology can meet its intended goal in enhancing road safety and reducing fatalities.

4. Driver Survey

4.1 Questionnaire Development

In order to evaluate public perception, user experience, and behavioral outcomes associated with ISA technology, a comprehensive survey was developed. The design of the questionnaire was influenced by a comprehensive review of already existing literature on ISA technologies and implementation while attempting to address gaps in consumer-focused ISA studies. This approach enabled the collection of the users' perspective and the lived experience of California drivers.

The development of the survey's questions branched off on a comprehensive review of ISA-related literature and pilot studies. Key themes extracted from related studied include user acceptance, perceived effectiveness, privacy concerns, and behavioral adaptability, which were used as the framework for the survey questions. Each question was designed to yield either quantitative or qualitative insight aligned with the research goals. Binary choices (such as Yes/No, Agree/Disagree) and the Likert-scale (Strongly Disagree/Strongly Agree) were utilized to assess perceptions, behavioral intent, and attitudes towards ISA system features, while multi-select (Select All That Apply) and open-ended formats were used to capture more nuanced concerns, implementation barriers, and personal preferences. This structured approach enabled the survey to balance standardization with flexibility, capturing both measurable trends and open-ended insights critical to ISA analysis.

4.2 Survey Structure

To ensure clarity and focus, the survey was divided into eight structured sections. These sections were organized based on the responses hypothesized to yield as indicated in Table 3: Section 1 collected demographic data to enable comparative analysis; Section 2 addressed ISA awareness and familiarity; Section 3 gauged the perception of and attitudes toward ISA, particularly regarding safety, trust, and control; Section 4 focused on the users direct experience with ISA-equipped vehicles; Section 5 measured behavioral tendencies such as speeding and anticipated ISA influence; Section 6 explored system preferences and feedback design for ISA features; Section 7 examined policy support and regulatory perspectives; and finally, Section 8 looked at privacy and data concerns of the system, providing a free-response portion for qualitative feedback and suggestions. The complete list of survey questions is provided in Appendix A for reference.

Table 3. Survey Structure

Survey Section	Purpose
Section 1	Demographics for comparative analysis
Section 2	ISA awareness and familiarity
Section 3	Perception and attitude towards ISA (safety, trust, control)
Section 4	User experience with ISA-equipped vehicles
Section 5	Driving behaviors and ISA systems anticipated influence
Section 6	System preference and ISA feedback design
Section 7	Policy support and regulatory perspectives
Section 8	Privacy and data concerns; open-ended feedback

4.3 Sampling and Distribution

To have a robust sampling, the survey was distributed primarily through Amazon Mechanical Turk (MTurk), targeting California-based drivers and filtering for active license holders. MTurk was selected due to its ability to deliver a diverse pool of participants which allowed for a balance in the demographics across urban and rural areas, while also conducting university outreach in order to ensure the at least 150 responses were collected.

4.4 Data Processing and Cleaning

Survey responses were compiled into Excel and converted into a structured format for analysis. All text-based responses were standardized and analyzed using Python for both descriptive statistics and visualization. The open-ended questions were analyzed by extracting recurring concerns and comments related to ISA implementation.

4.5 Survey Results

This section displays the results of the ISA survey administered to California drivers. The survey yielded 286 complete responses, which were cleaned and analyzed using Python. Results were then categorized into eight sections: demographics, ISA awareness and familiarity, perception, personal experiences, behavioral responses, design preferences, policy attitudes, and policy concerns.

4.5.1 Demographics of Respondents

To provide a meaningful basis for interpreting survey results, demographic data was collected in the first section of the survey. These questions established the age, gender, racial/ethnic identify, living area, and typical driving environment of respondents. As shown in Figure 13, the sample was largely composed of younger adult drivers, with the largest segment (about 50%) aged 25–34, followed by 18–24-year-olds and 35–44-year-olds.

Figure 14 illustrates gender composition, with the majority being male participants. Racial and ethnic demographics are displayed in Figure 15, with most respondents identifying as White, Hispanic, and Asian. To assess driving environments, respondents were asked about their typical residential area. As shown in Figure 16, people living in urban (highly populated areas), though rural and "other" environments were also represented. Figure 18 shows that most participants reported driving on a mixture of highway and local streets rather than just one road type.

Figure 13. Age Range of Respondents

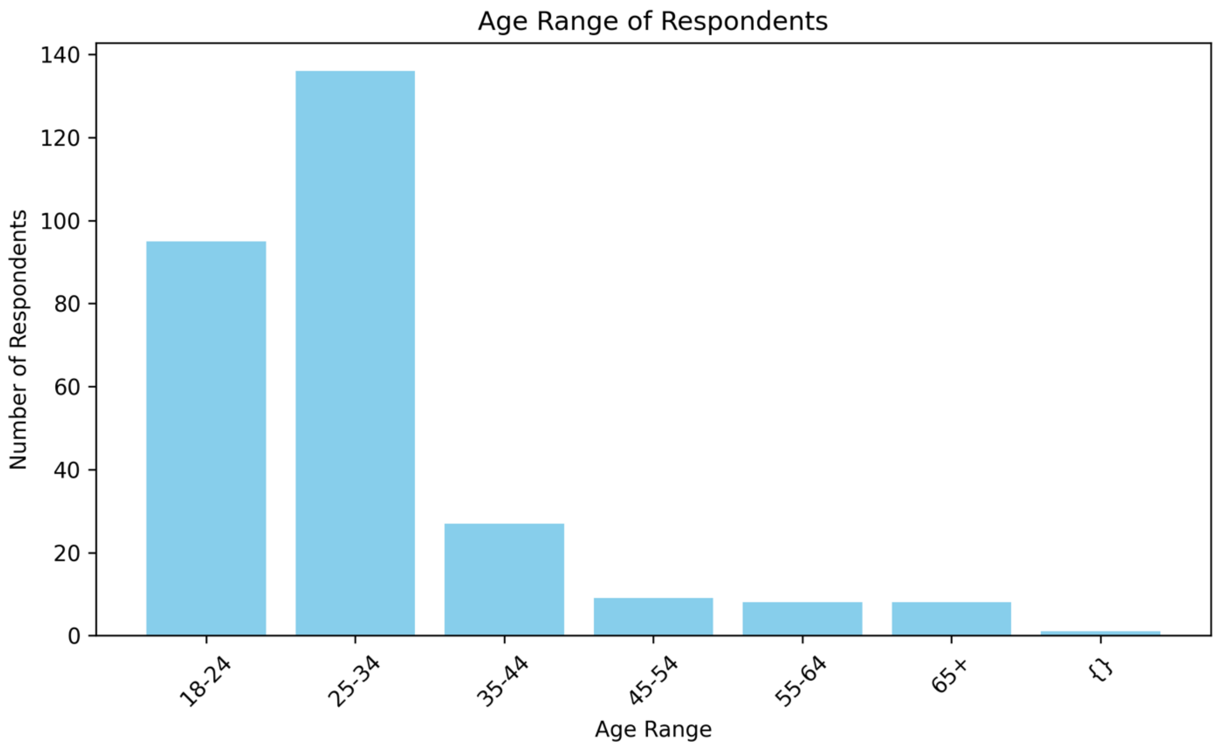


Figure 14. Gender of Respondents

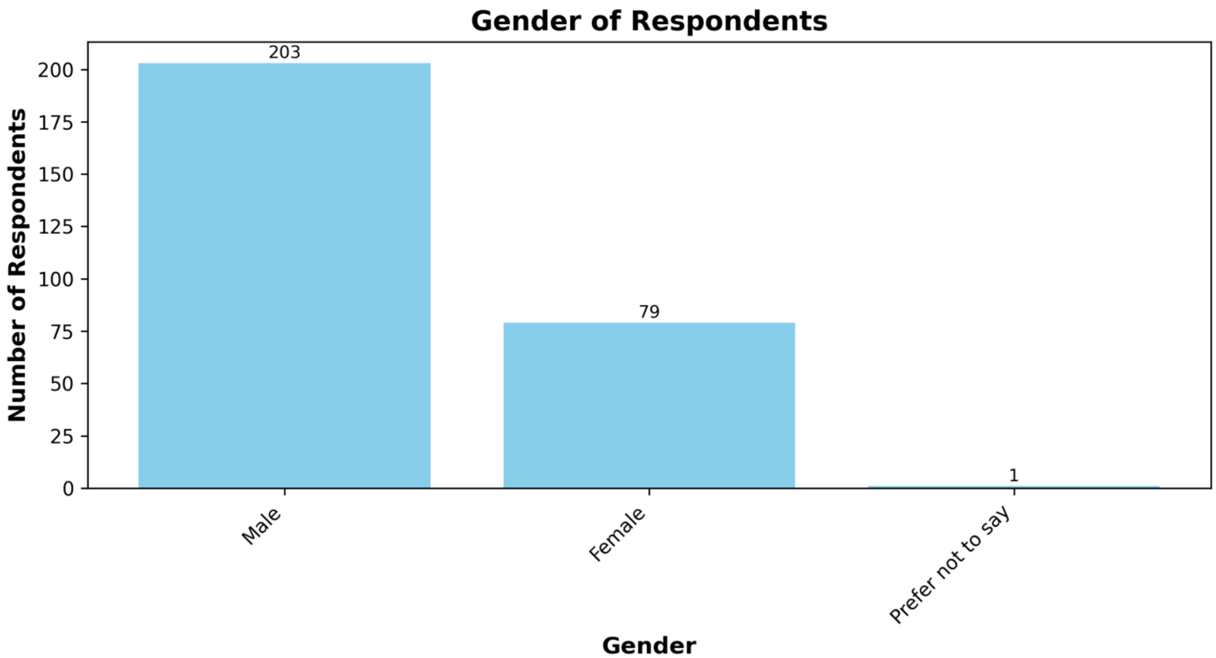


Figure 15. Demographics of Respondents

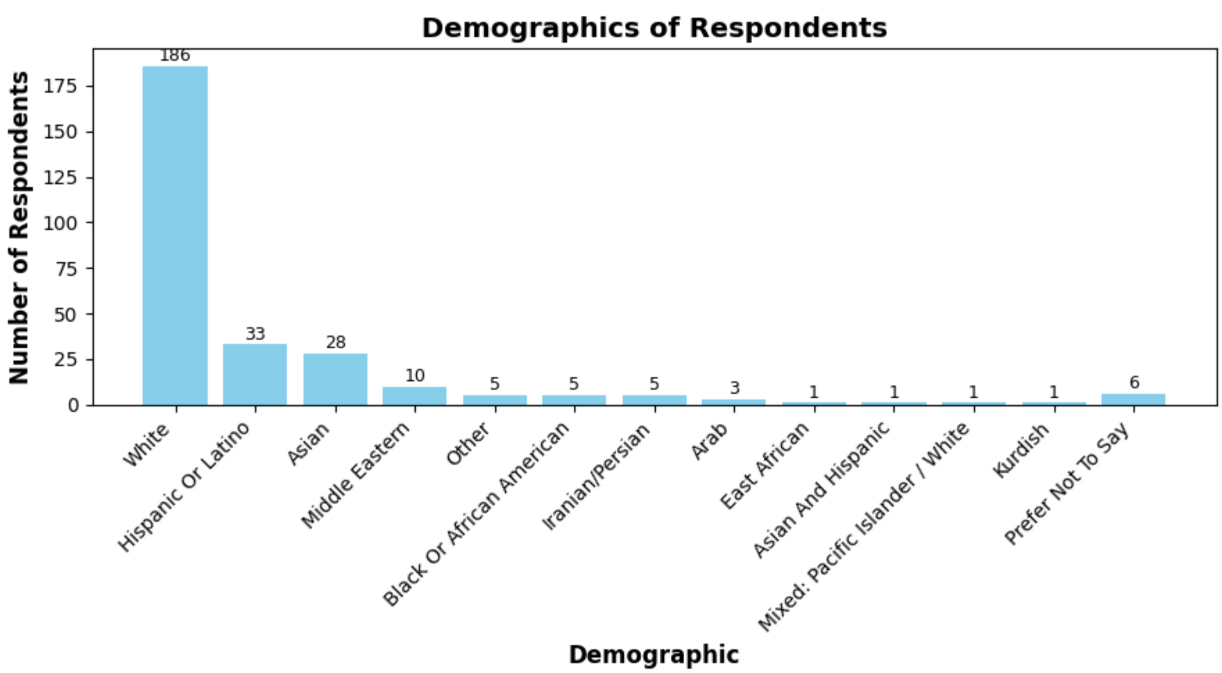


Figure 16. Living Area of Respondents

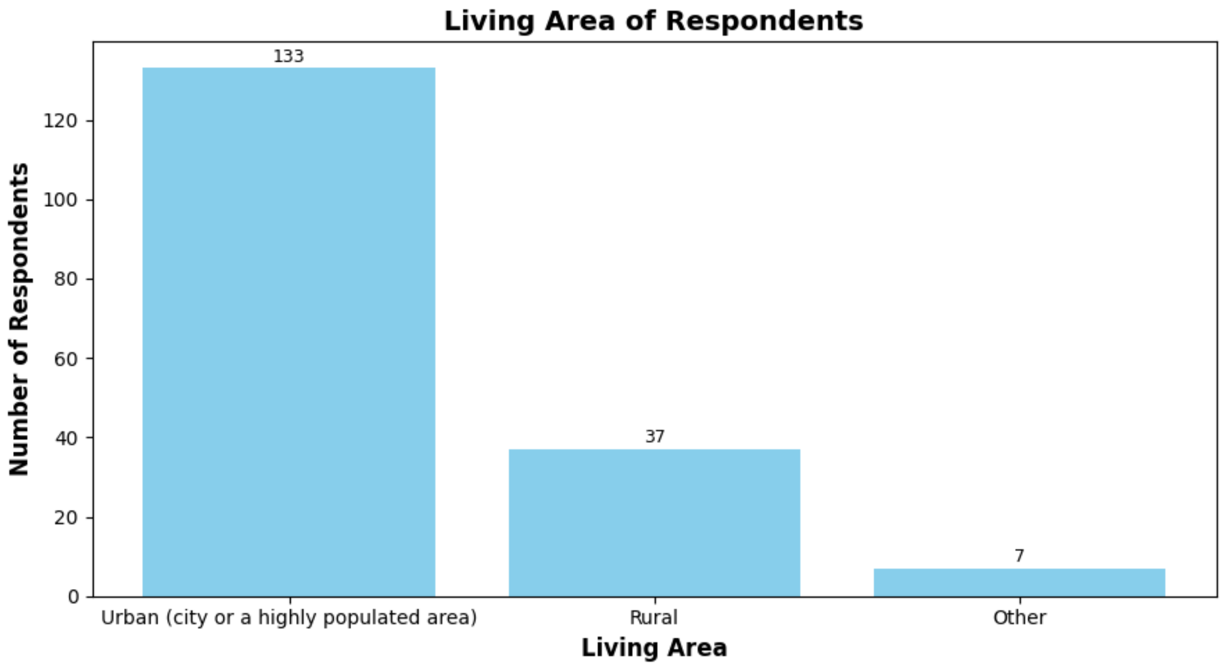
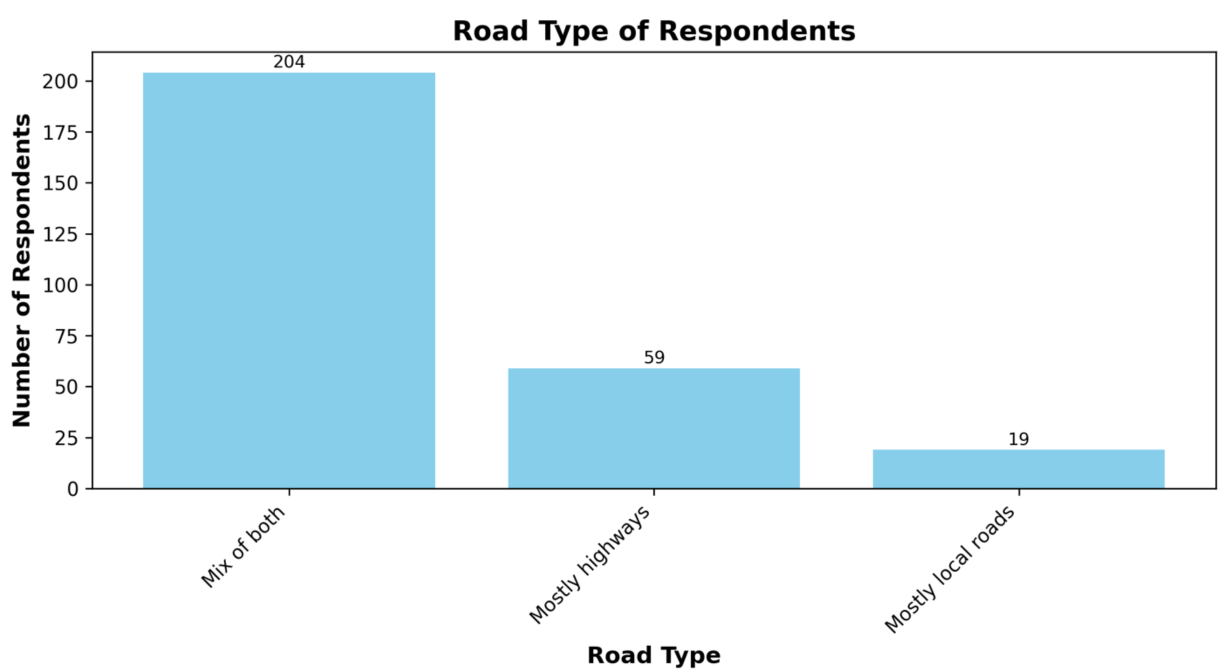


Figure 17. Road Type of Respondents



4.5.2 ISA Awareness and Familiarity

The second section of the survey was designed to establish a baseline understanding of ISA awareness and exposure among drivers. Participants were first asked whether they had heard of ISA prior to taking the survey. As seen in Figure 18, while general awareness of ISA exists among many drivers, in-depth familiarity with system operations and functionality remains moderate. Even among those who have heard of ISA, self-reported familiarity remained moderate as seen in Figure 19. Most respondents ranked their familiarity as “Slightly familiar” or “Not familiar at all,” underscoring the novelty of the technology among general drivers, while on the other hand, a number of respondents indicated great awareness with the system as well.

Respondents who had heard of ISA were asked to indicate the source of information about technology. The multi-selected responses summarized in Figure 20 indicate that internet-based sources (e.g., articles, blogs, social media) were the most cited, followed by word-of-mouth and occasional exposure through car reviews or automative news. Exposure through manufacturing, marketing, or government outreach was minimal. Questions regarding the users’ in-vehicle experience were asked. When the users were asked whether they have seen any advertisements or promotional content about ISA, the responses shown in Figure 21 indicated high exposure, with 194 respondents choosing “Yes,” while 84 chose “No.” Figure 22 shows that approximately 67% of the respondents believed that their current vehicle was equipped with some form of Advanced Driver Assistance System (ADAS) or ISA, indicating the implementation and growth of technology adoption.

Figure 18. Familiarity with ISA

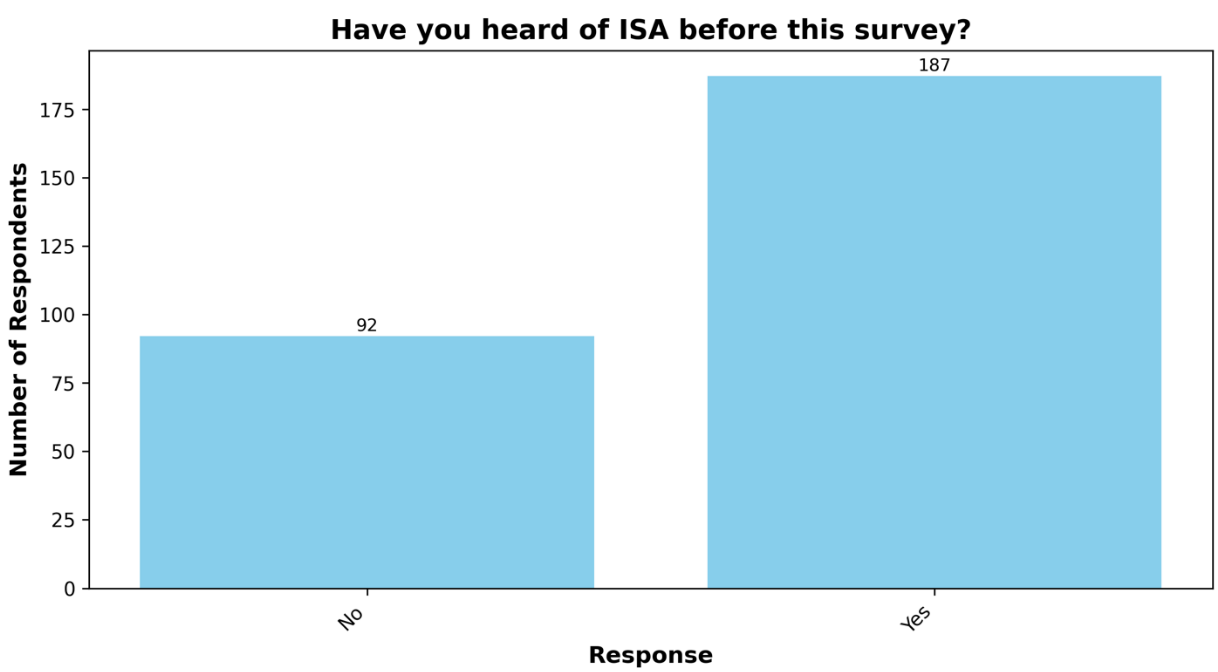


Figure 19. Degree of Familiarity of ISA Systems

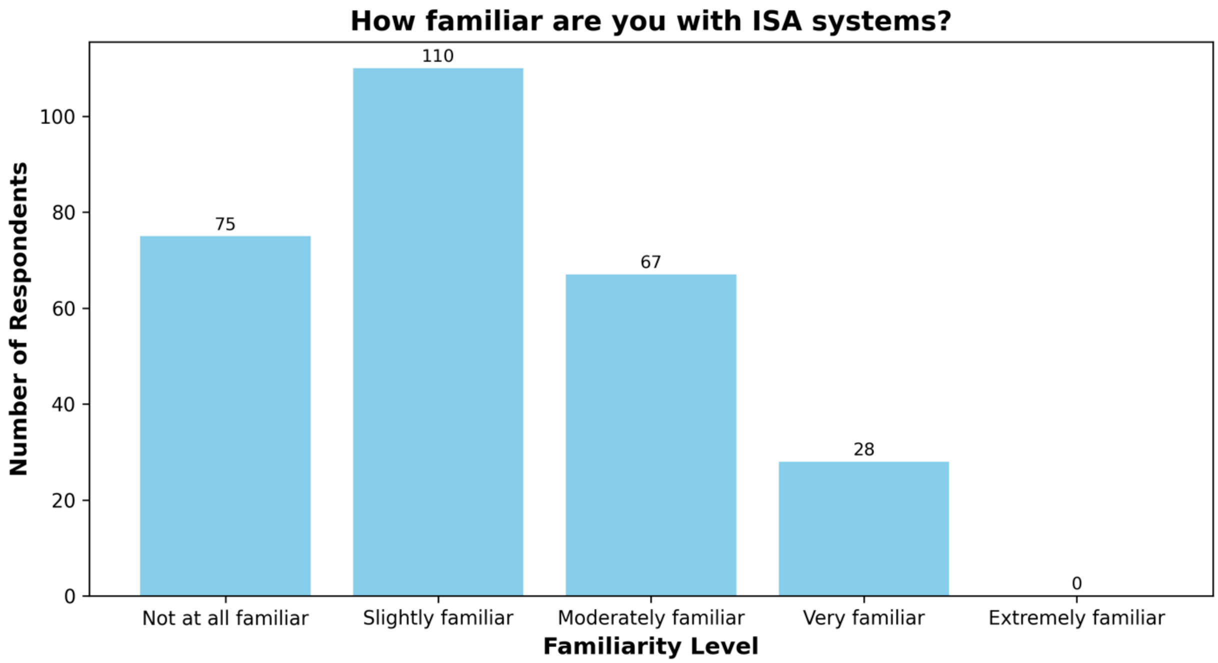


Figure 20. ISA Knowledge Source

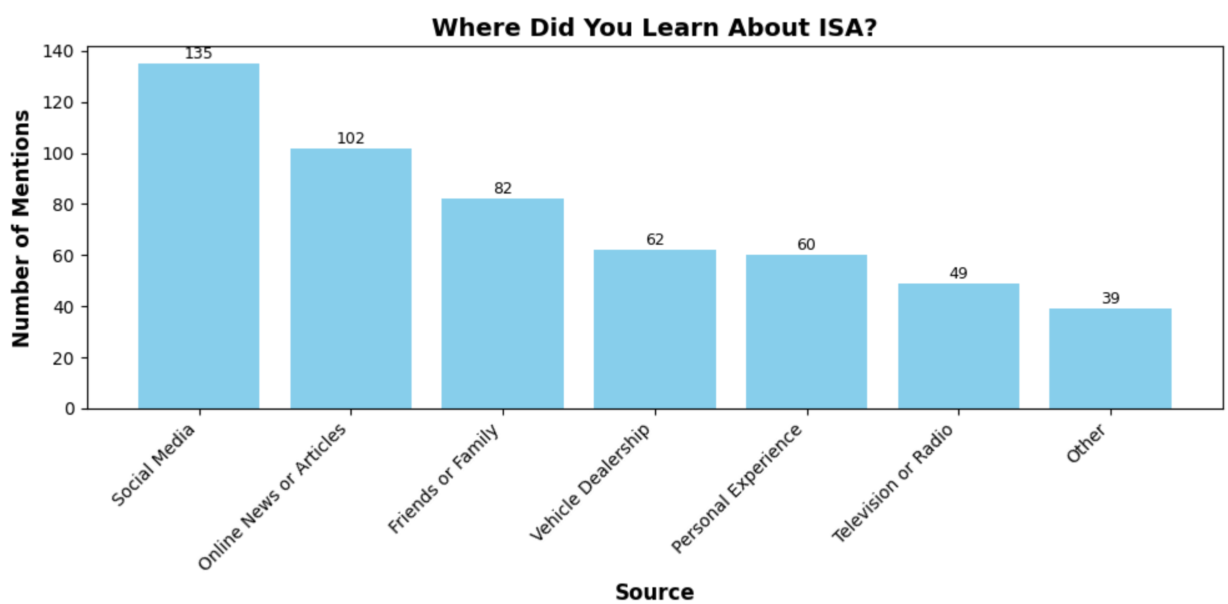


Figure 21. Advertisements Regarding ISA

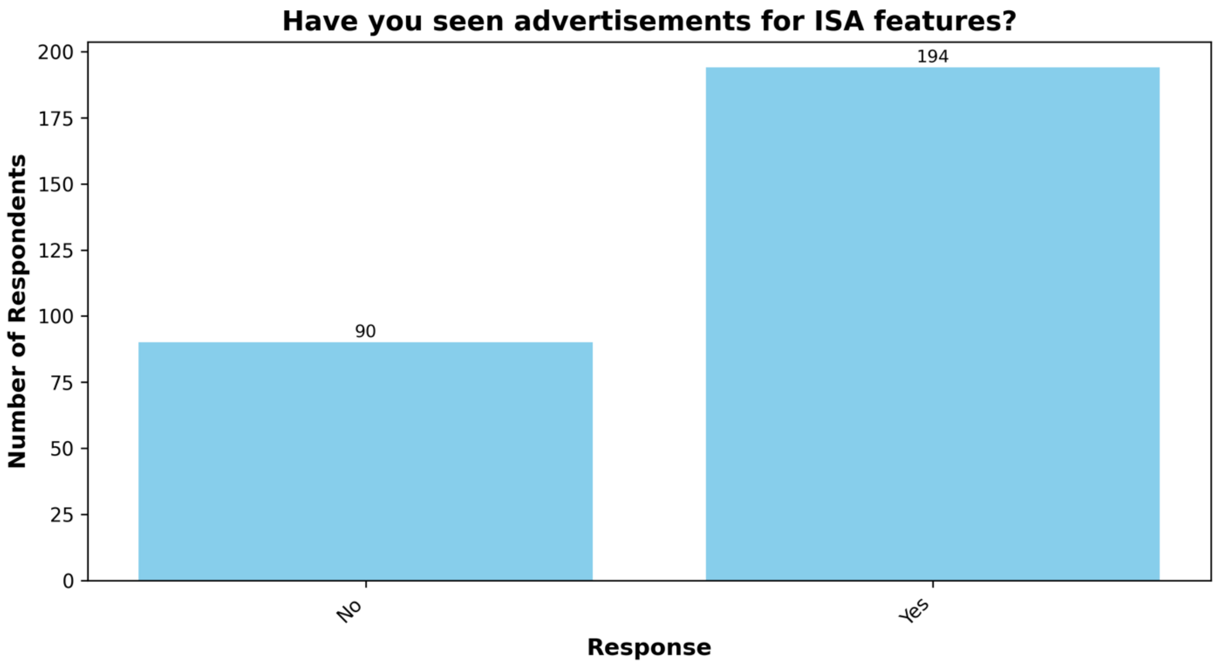
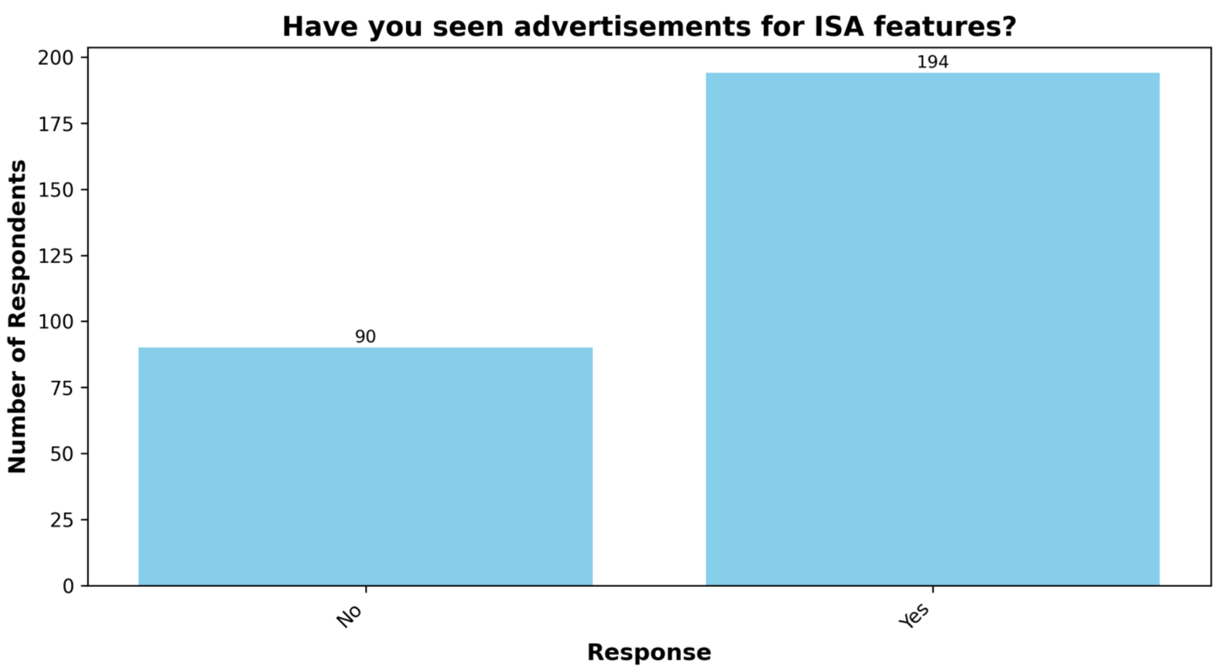


Figure 22. Respondents' Vehicle Systems



4.5.3 Perception and Attitudes Toward ISA

The third section of the survey assessed the public's perception and psychological attitudes towards ISA systems. This section aimed to measure the respondents on their comfort with the technology, perceived safety benefits, concerns, and the potential of ISA's impact on the driver. The responses were captured through the use of Likert-scale and multi-select formats.

In Figure 23, responses to the question "Do you believe ISA systems can improve road safety by reducing speeding?" show that over 50% of drivers responded with "Agree" or "Strongly Agree," suggesting that most participants acknowledge the potential safety benefits of ISA. However, a notable number of respondents indicated disagreement or neutral beliefs. This was then challenged when the users were asked to select all the concerns they had about ISA systems. Figure 24 shows that the most common responses included the loss of control, potential for system malfunction, and inaccurate speed limit detection. Privacy concerns and distracting alerts were also frequently mentioned, reflecting public skepticism regarding automation and surveillance.

Figure 23. Road Safety Perception with ISA Implementation

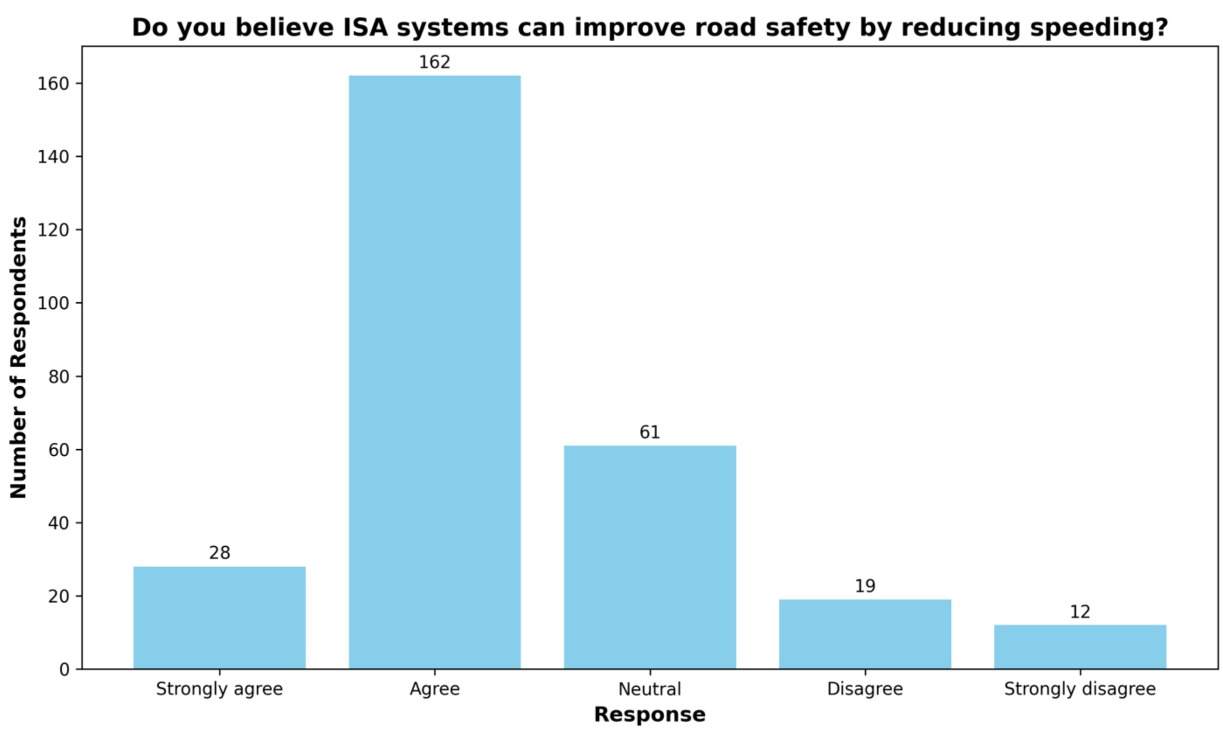
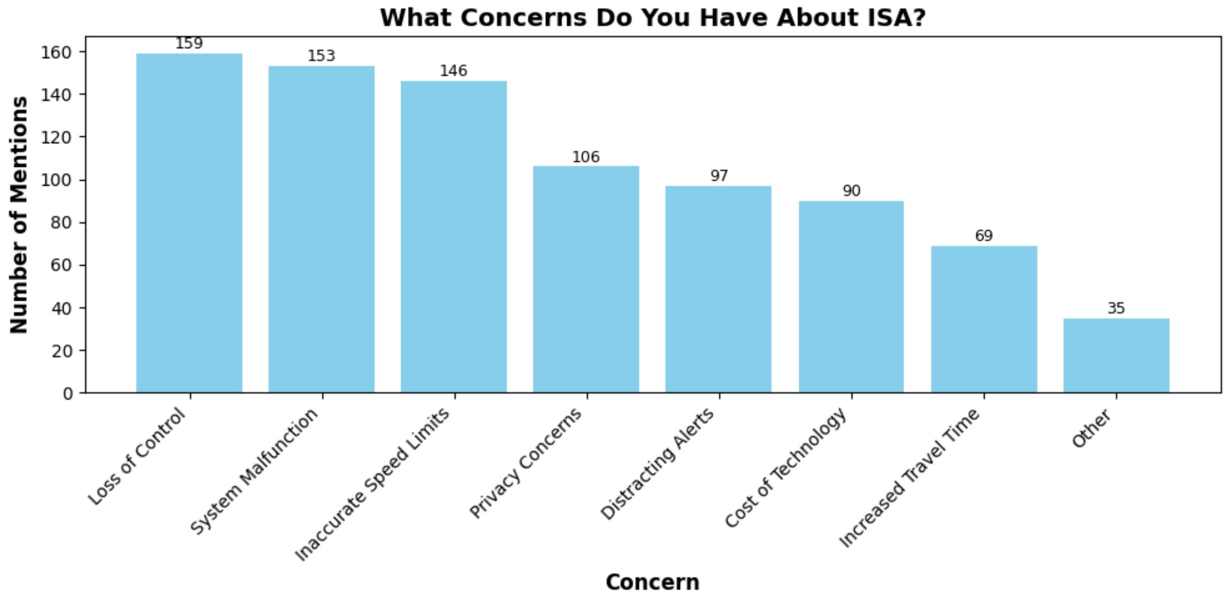


Figure 24. Respondents' Concern Regarding ISA



Attitudes towards ISA comfort and control were assessed further as shown in Figure 25. When users were asked how comfortable they would feel using a vehicle with an ISA system that limits speed, responses yielded from both ends of the spectrum, with the majority of users reporting they were "somewhat comfortable," while 150 respondents expressed discomfort or uncertainty. Finally, Figure 26 presents the question "Do you feel ISA intrudes on your driving freedom?" The results indicated that nearly two-thirds of the respondents believed that ISA technology limits drivers' control, while 41 users were unsure, which may present a substantial barrier to user acceptance and long-term adoption.

Figure 25. Respondents' Comfort with ISA Systems

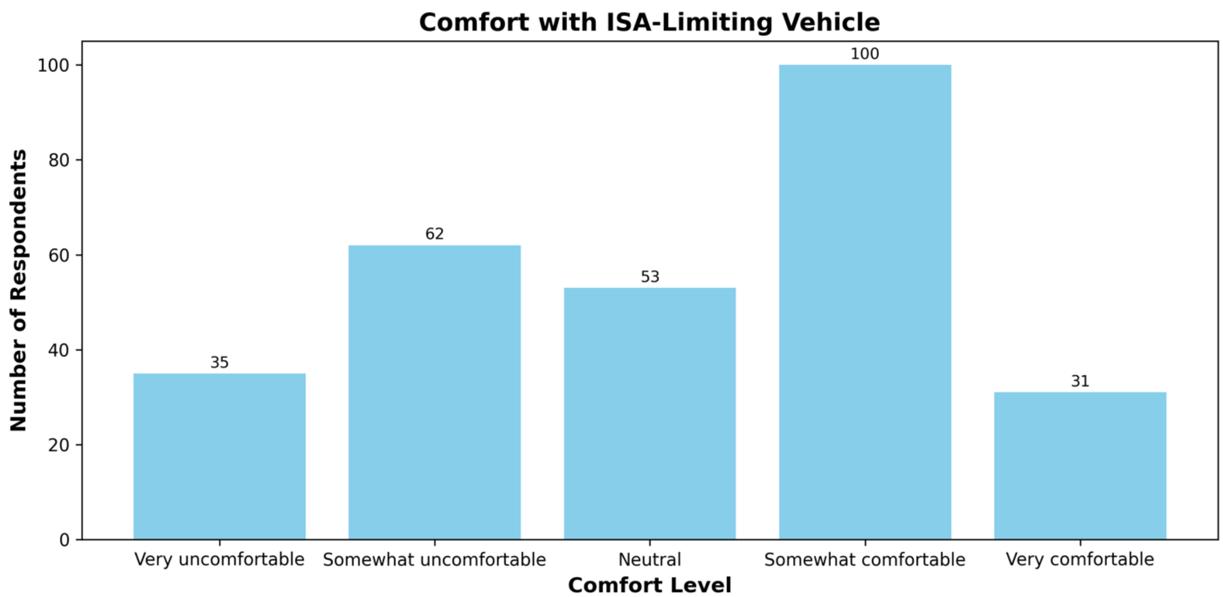
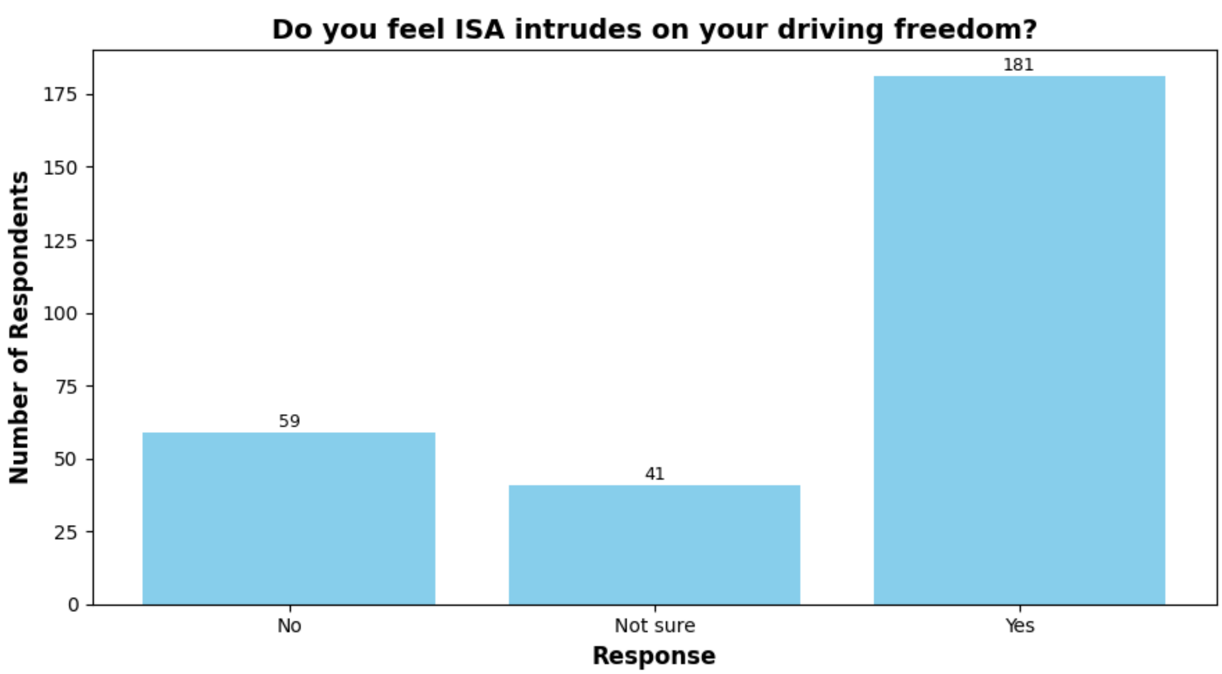


Figure 26. ISA Freedom Concerns



4.5.4 Experience with ISA

This section explores the participants' experience with ISA-equipped vehicles or ISA-related features/addition. Understanding firsthand exposure is critical to interpreting behavioral expectations, due to how prior use may influence levels of acceptance, trust, or skepticism.

First, the respondents were asked whether they have ever driven a vehicle equipped with ISA. As displayed in Figure 27, the results were semi-balanced, with 147 respondents stating "Yes" and 135 indicating that they had not encountered ISA, which reinforced earlier findings indicating that awareness and exposure remain limited in the general driving population. Among those who reported having used ISA, participants were asked how frequently they interacted with the system. A large portion indicated using it "Often" or "Sometimes," while 33 respondents reported rarely using the system at all (Figure 28). This data suggests that, even among individuals who are aware of ISA, the usage remains at a moderate level and is not fully utilized, even though respondents indicated their usage level at "Often" or "Sometimes."

Figure 27. Utilization of ISA-Equipped Vehicles

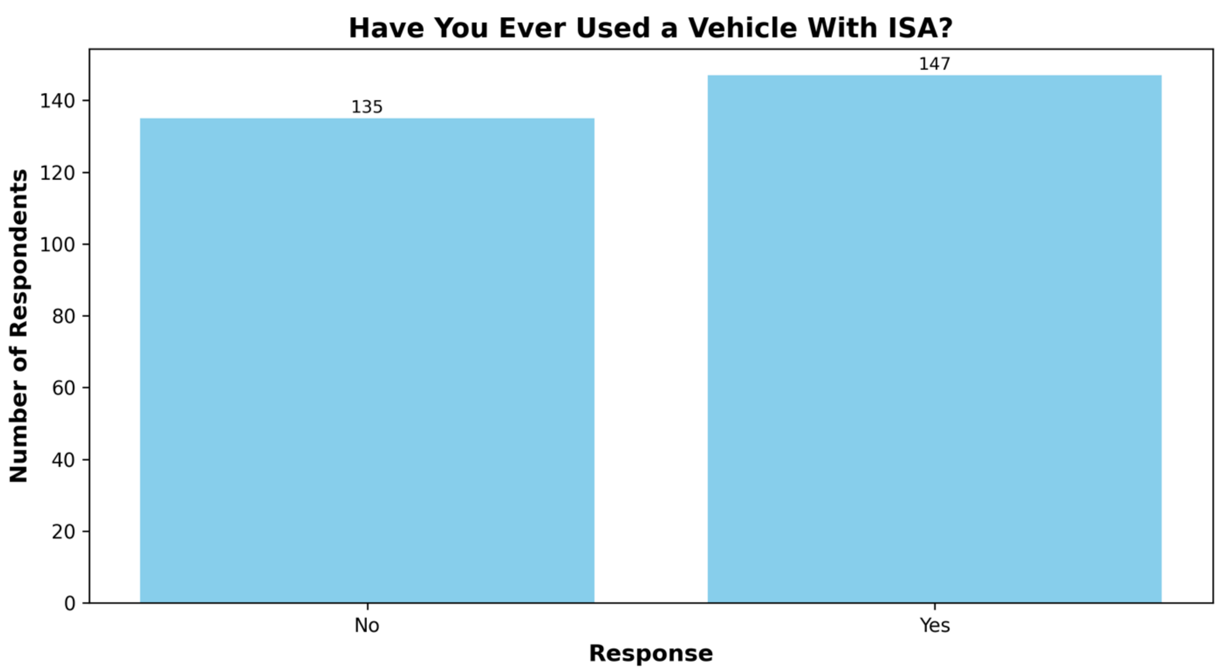


Figure 28. Usage Frequency of ISA Systems

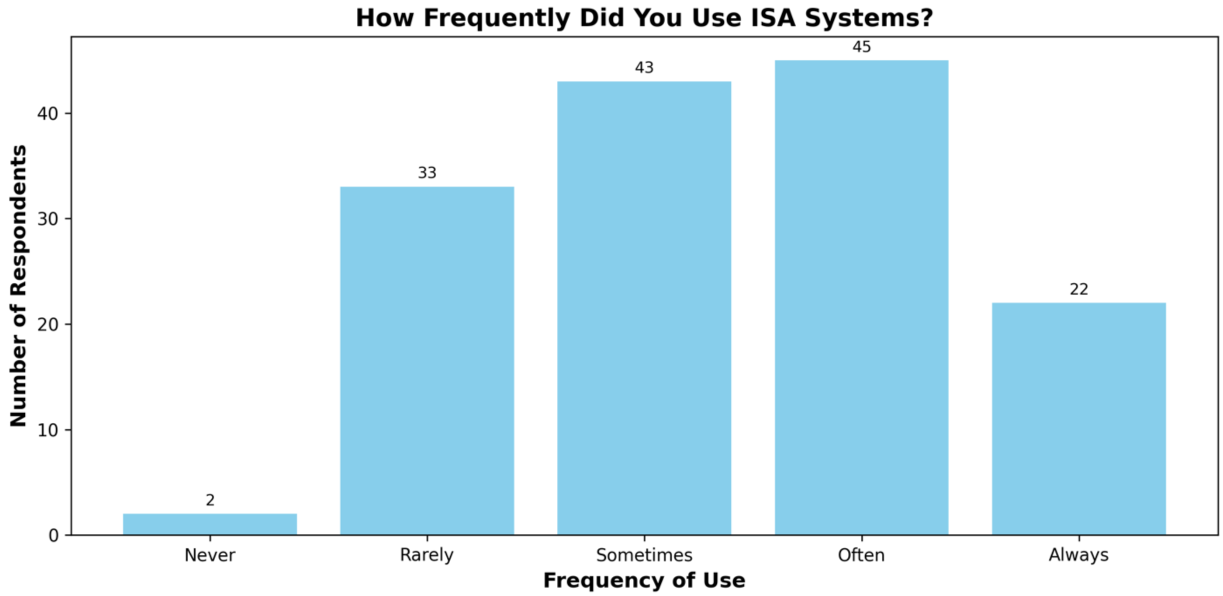


Figure 29 displays responses to questions based on ISA experiences that asked the users about the system's accuracy. Seventy-two respondents indicated that the system was somewhat accurate, while 37 respondents saw inaccuracies in the systems. The responses indicated a variation of accuracy, raising awareness to the necessity of up-to-date speed maps. However, when asked about the challenges faced by the system, many respondents had not interacted with ISA, and a portion of those who had reported disabling or overriding it, often mentioning frustration, a lack of control, or system inflexibility, as shown in Figure 30.

Figure 29. ISA Accuracy

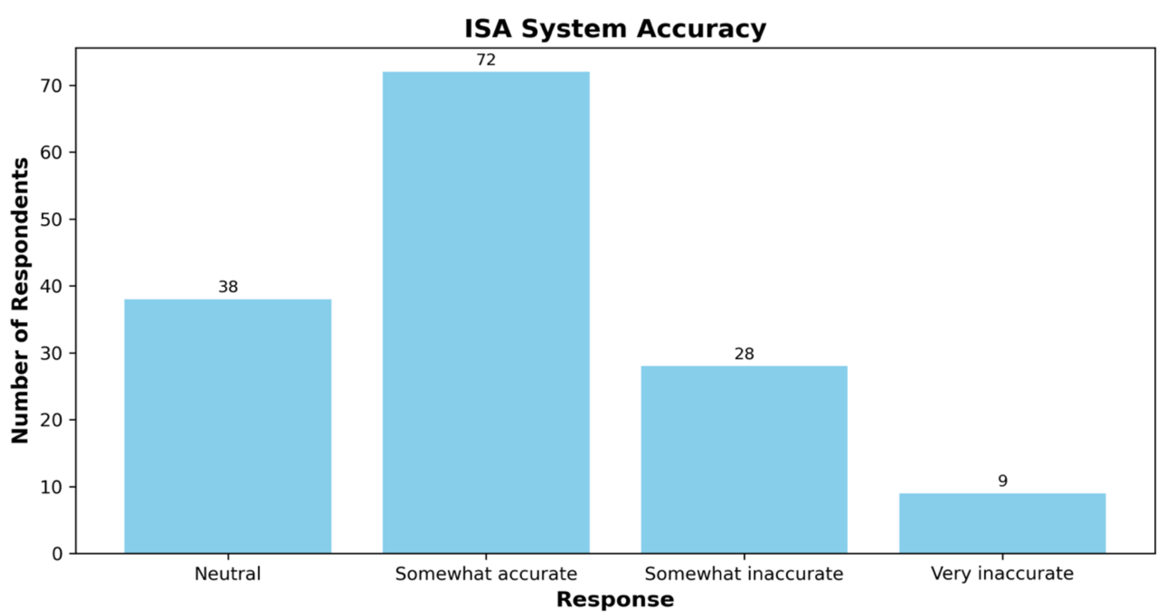
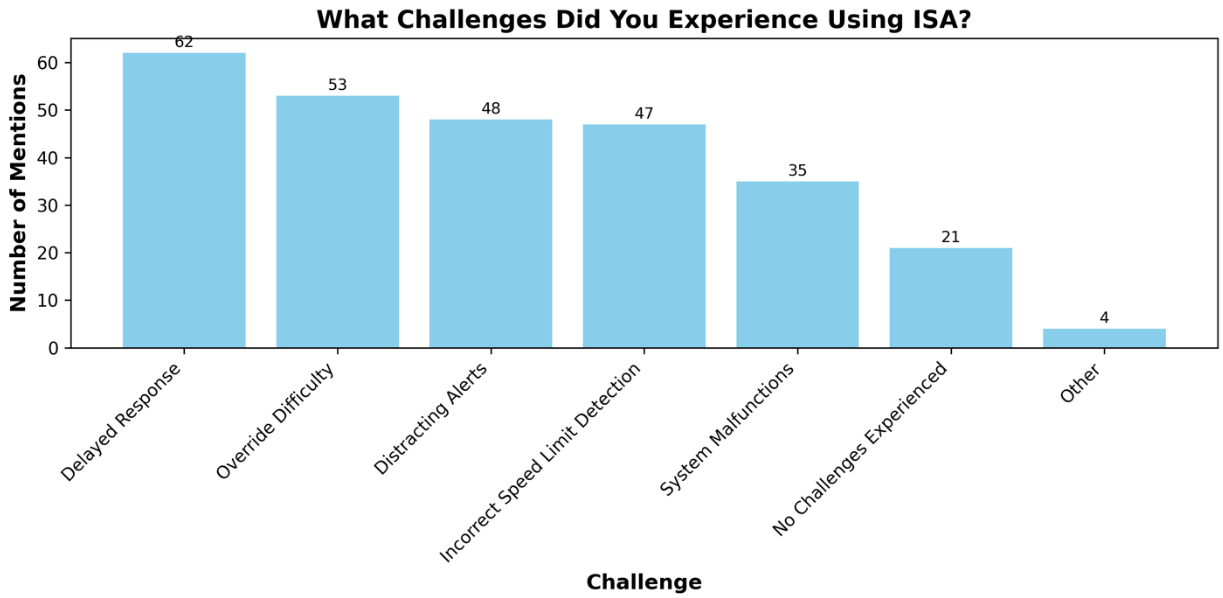


Figure 30. Challenges Experienced with ISA



4.5.5 Driving Behavior and ISA Influences

In relation to gaining insight about ISA's popularity, respondents were asked to self-report speeding tendencies across different road environments which allowed for an assessment of behavioral and psychological responses to ISA technology. The questions were designed to explore not only whether drivers engaged in speeding but also how ISA might influence their tendencies, along with its potential to affect stress levels and confidence of the users behind the wheel.

Participants were initially asked to report their driving speeds in two scenarios: on the freeway and on local streets. As displayed in Figure 31, freeway behavior indicated significant variability, with a great portion of respondents reporting "slightly exceeding" posted speed limits (5–10 mph over). Figure 32 illustrates respondents' behavior on local roads, where they reported a greater tendency to adhere to posted speed limits. A common trend emerged between speeding behavior on freeways and local streets. As shown in Figure 33, a notable portion of respondents reported either strictly following or slightly exceeding speed limits across both road types. However, relatively few respondents admitted to significantly exceeding the limit (by 10–15 mph), suggesting that minor speeding is common among California drivers regardless of road type.

Figure 31. Respondents' Freeway Behavior

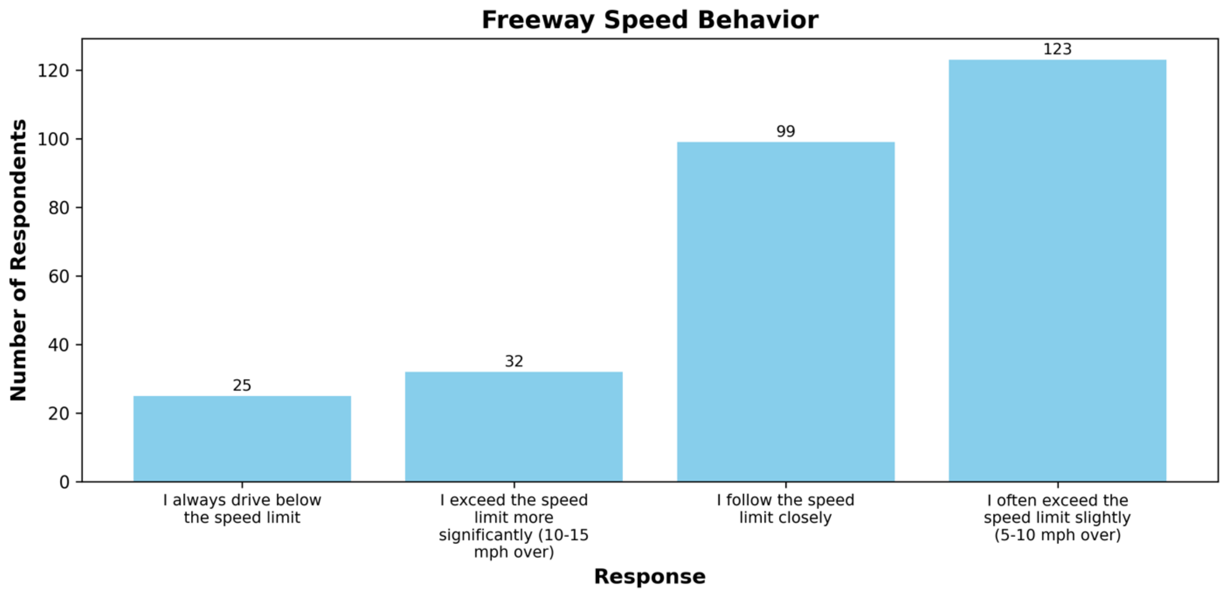


Figure 32. Respondents' Local Road Behavior

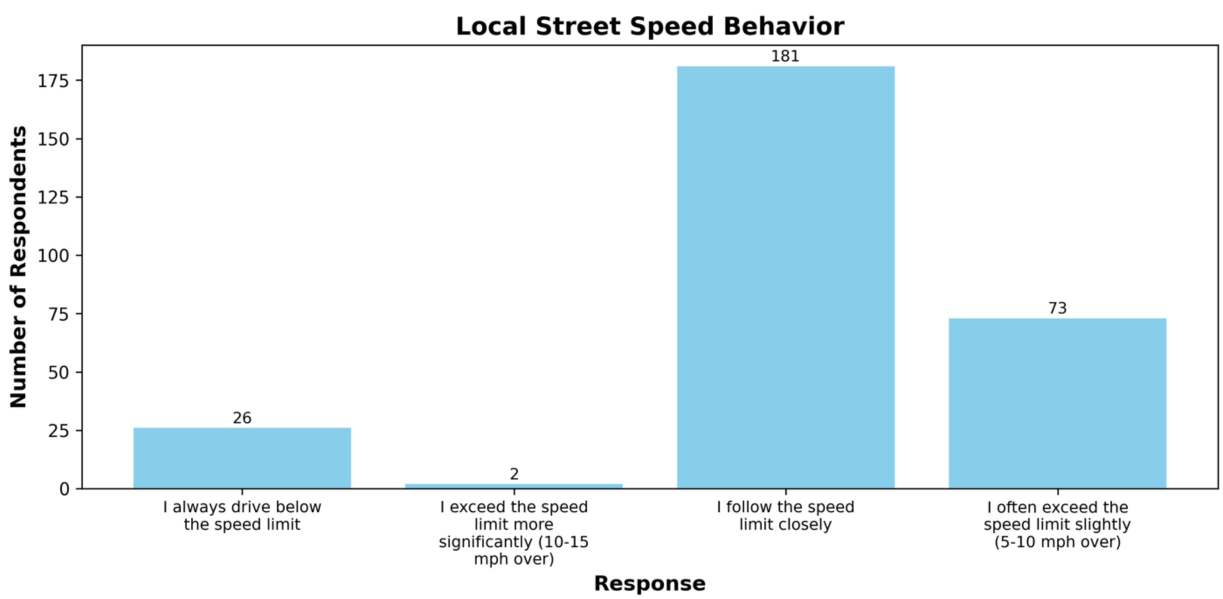
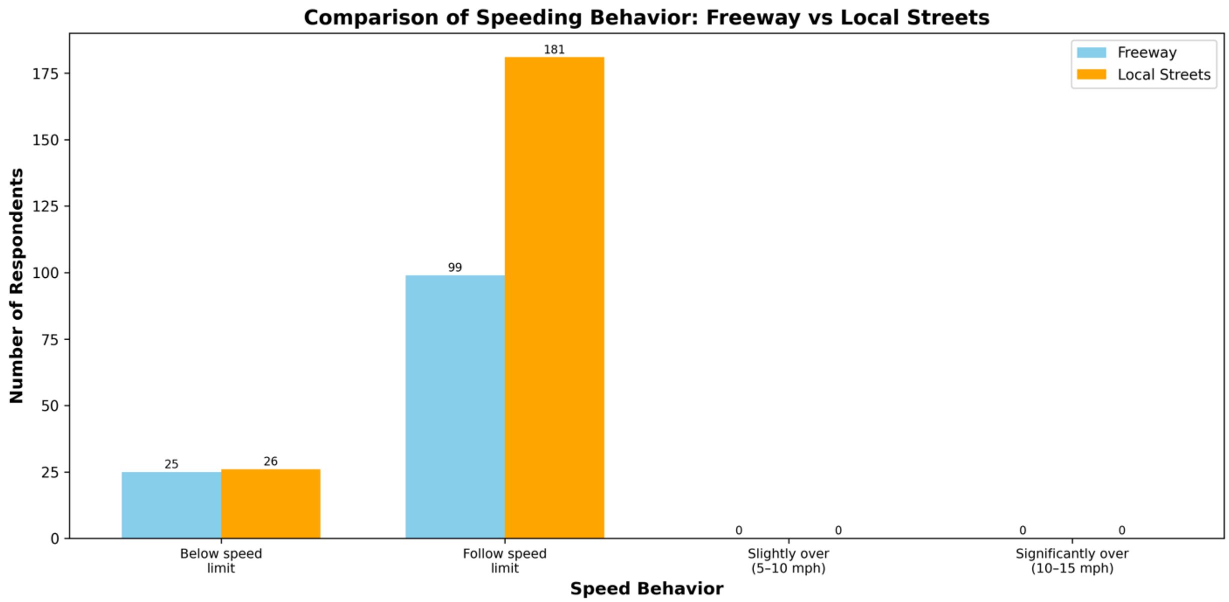
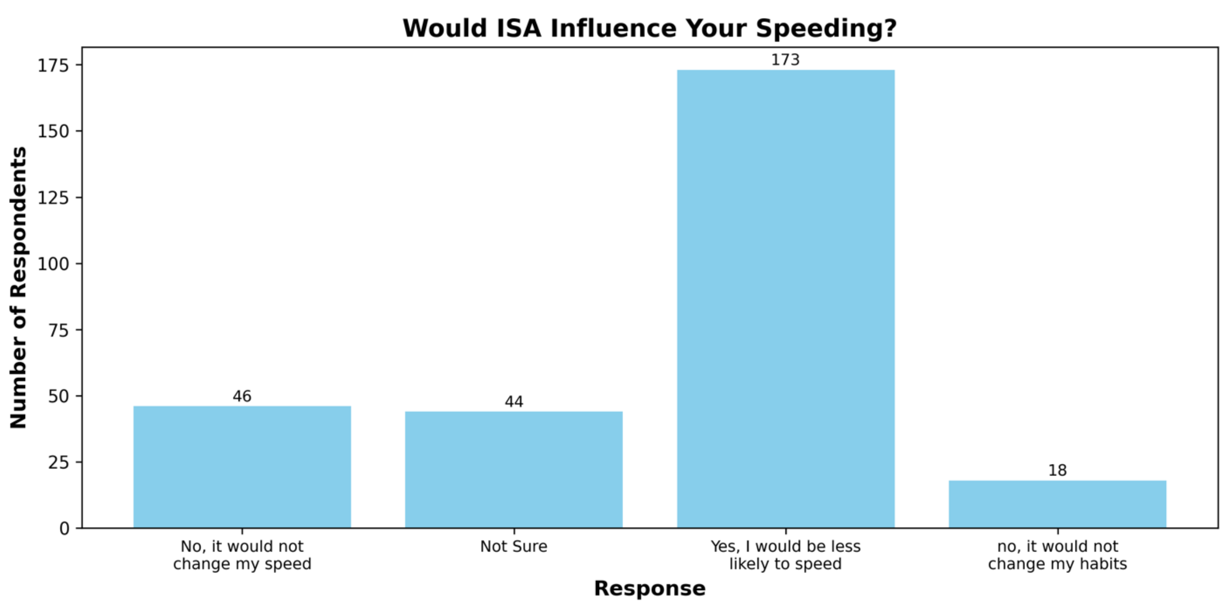


Figure 33. Comparison of Drivers' Behavior on Freeways and Local Roads



Following this, the potential influence of ISA systems on drivers' speeding habits was evaluated. Figure 34 shows that the majority of respondents—over 62%—indicated that participants would be less likely to speed if ISA were implemented in their vehicle. Only a small fraction of respondents stated that they would maintain their current habits, while the rest expressed uncertainty. The findings support the grounds that ISA has the capability to impact drivers' behaviors in reducing recreational speeding.

Figure 34. ISA Influence on Speeding



After gaining insight into behavioral impacts, the potential psychological effects associated with ISA implementation were explored. Figure 35 indicates whether ISA would alter stress levels while driving. A notable number of 100 respondents replied that there would be no change in their stress levels, while 79 replied that they would be somewhat more stressed, implying an increase in stress levels caused by advanced systems. Additionally, Figure 36 shows that the majority of respondents agreed that ISA could reduce the likelihood of receiving speeding tickets. On the other hand, 37 respondents believed that ISA would not decrease speeding tickets. Finally, Figure. 37 examines changes in driving confidence; although the responses were broad across the spectrum, 115 respondents indicated that ISA potentially could increase their confidence behind the wheel, while 164 indicated that it would not impact or negatively impact their confidence level.

Figure 35. ISA Influence on Driving Stress

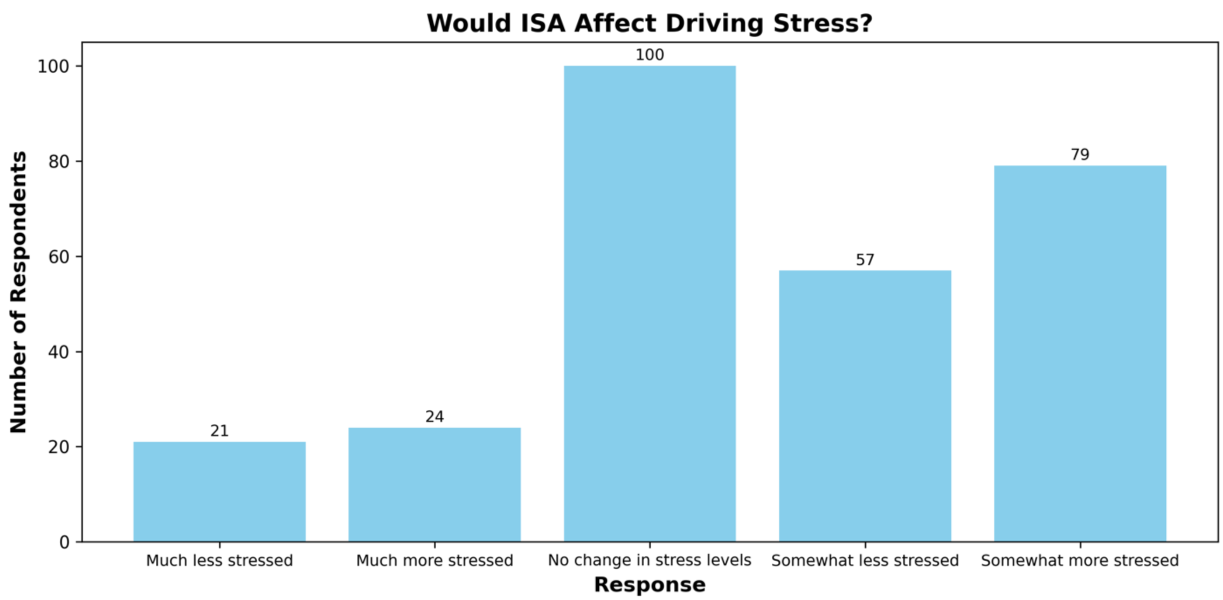


Figure 36. Respondents' Perceived Influence on Speeding Tickets

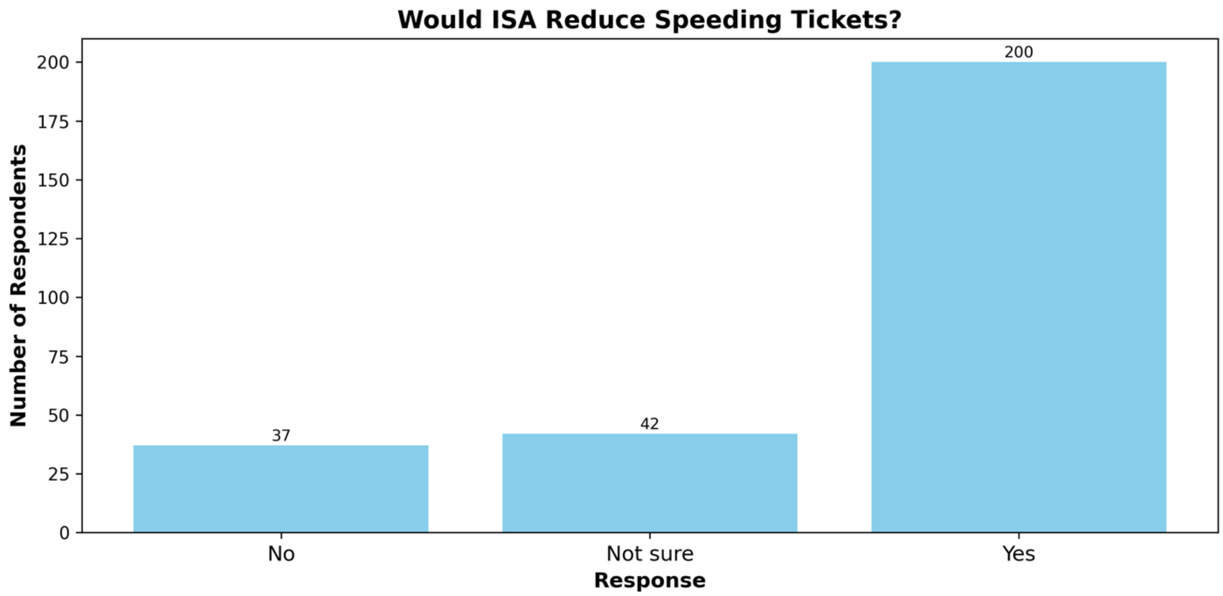
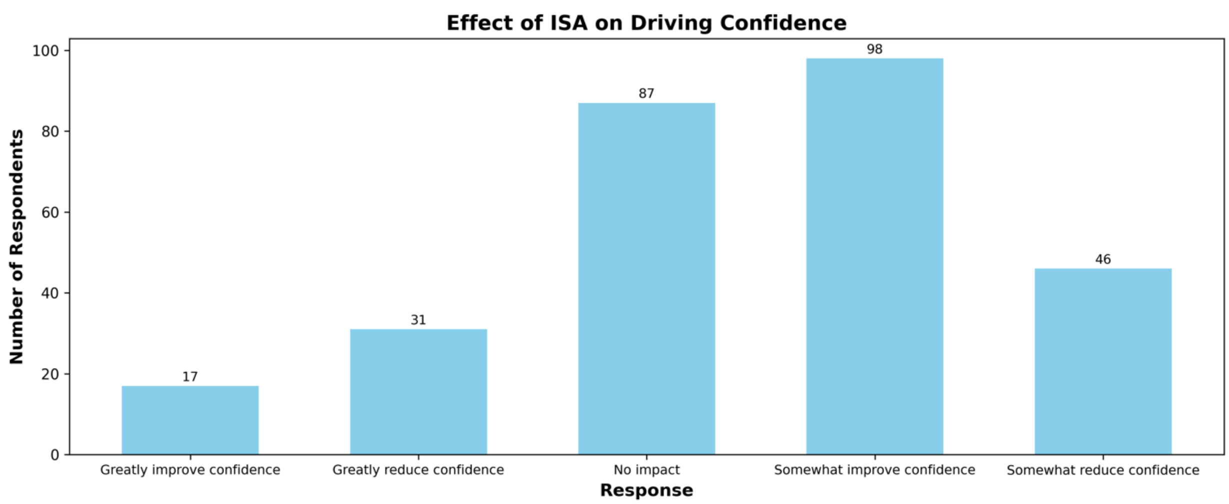


Figure 37. Effect of ISA on Driving Confidence

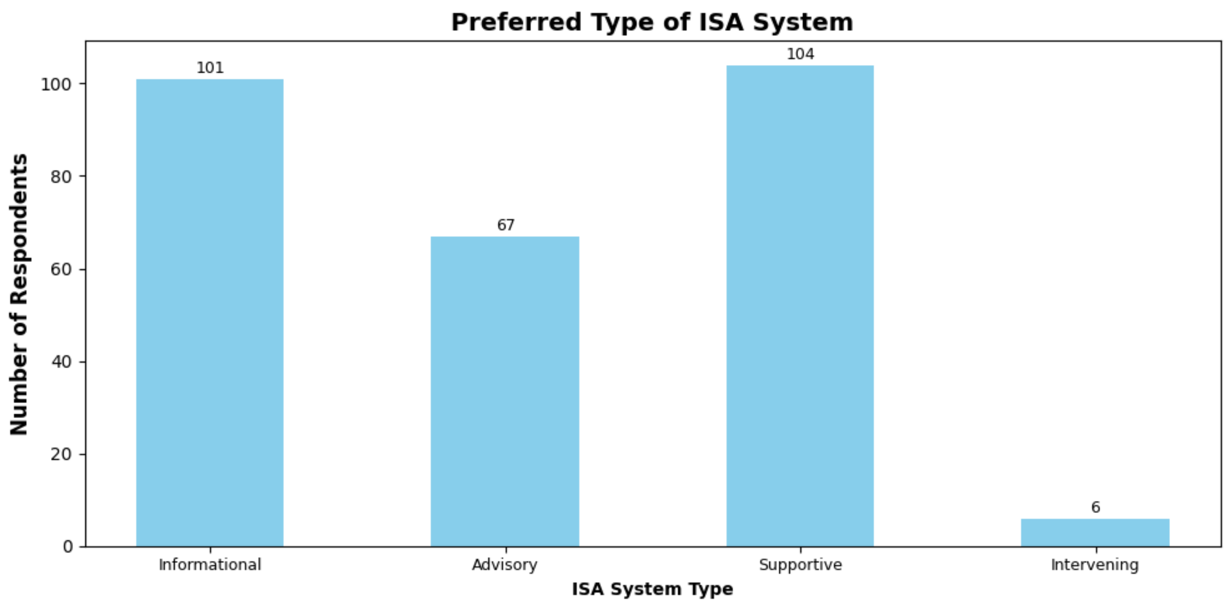


4.5.6 System Preferences

To understand the public's preferences regarding the design and functionality of ISA systems, the survey included two questions assessing system type and feedback mechanisms. These insights are critical to designing a driver-centered system, ensuring the systems aligns with the driver's expectation.

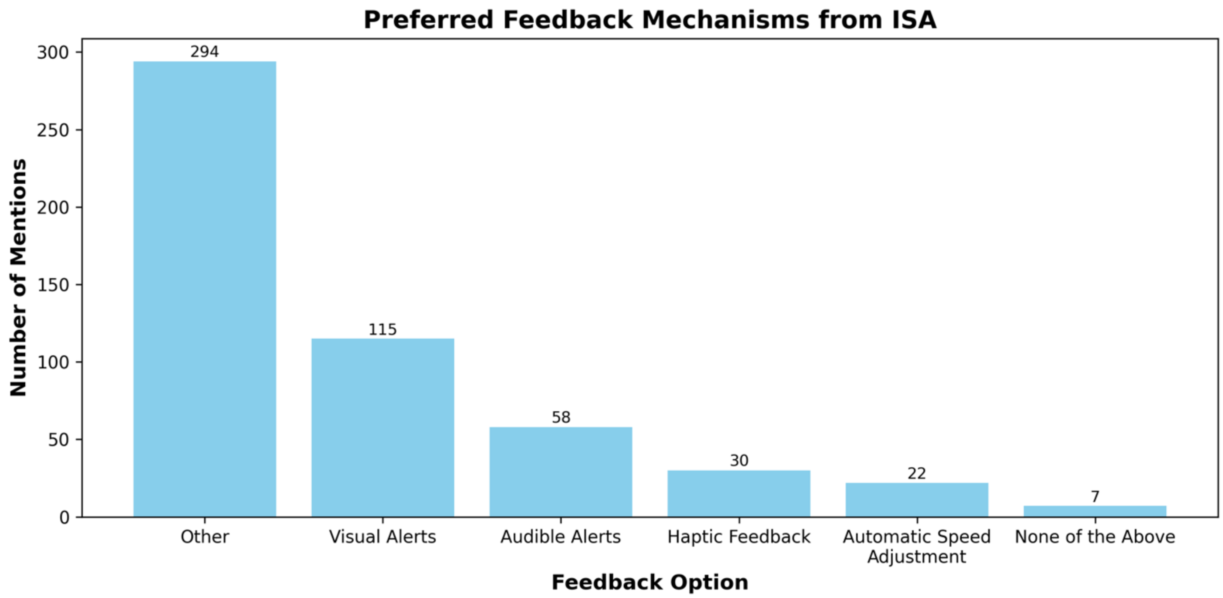
Question 27 asked the respondents to indicate their preferred type of ISA system. As displayed in Figure 38, the responses were grouped into four main categories: Advisory, Informational, Supportive, and Intervening. The most significant category deemed by the respondents was Supportive systems, with 104 selections, which adapt vehicle behavior in real time but allow manual override, followed by Informational systems, with 101 selections, which only display the posted speed limit without alerts or actions. Advisory systems, which includes systems that provide non-intrusive notifications or alerts without enforcing the posted limit, ranked third with 63 responses. Coming in as the least preferred were Intervening systems, with 6 responses, which control the speed of the vehicle, regulating the speed without the driver's input. This highlighted that an advisory system is significantly favored than full automation.

Figure 38. Preferred Type of ISA Systems



Question 28 posed a variety of feedback mechanisms, allowing the drivers to choose which ISA system features were favored. Figure 39 displays the degree to which the mechanism was preferred. The "Other" option was selected most frequently, with 294 respondents often referencing customization, override functionality, or privacy concerns in their open-ended responses. Visual alerts were favored by respondents, followed by audible alerts and haptic feedback. Haptic feedback (such as vibrations in the steering wheel or pedals) was deemed to be the least favorable informational systems, while "Automatic Speed Adjustment," which gives full autonomy to the ISA system, was deemed to be least favorable among all systems. The respondents displayed a skew in responses when asked to select intervening systems: few selected "Automatic Speed Adjustment," while some selected "None of the Above," indicating a resistance to feedback-based intervention entirely.

Figure 39. Preferred ISA System Feedback



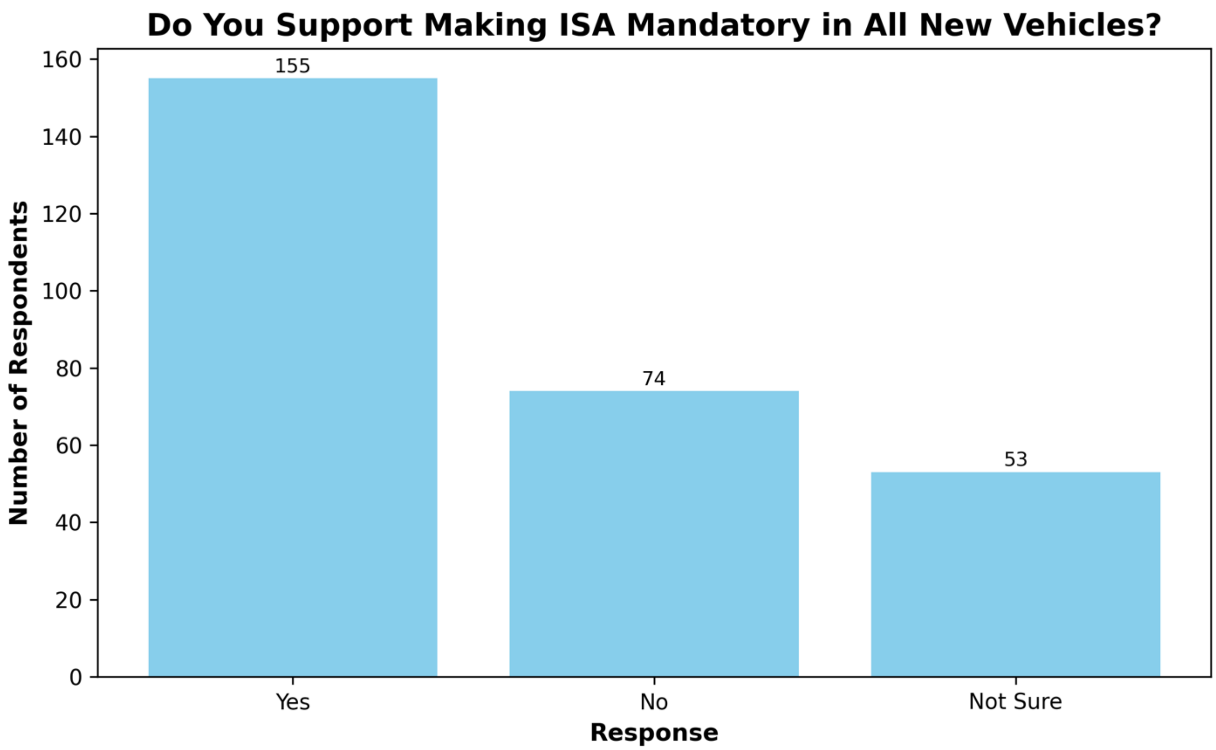
The respondents confirmed that drivers are generally supportive of informative and assistive ISA technology which includes systems allowing the driver to remain in control and receive feedback from the system. This is significant for ISA implementation, suggesting that adoption may hinge on the system's ability to assist without overwhelming the driver in the process.

4.5.7 Policy Attitude

To gain an understanding of the public's perspective of ISA mandates and incentives based on implementation strategies, respondents were asked three policy-related questions. The questions assessed whether financial or convenience-based incentives would influence their perception of ISA, and whether ISA restrictions should vary based on geographics locations.

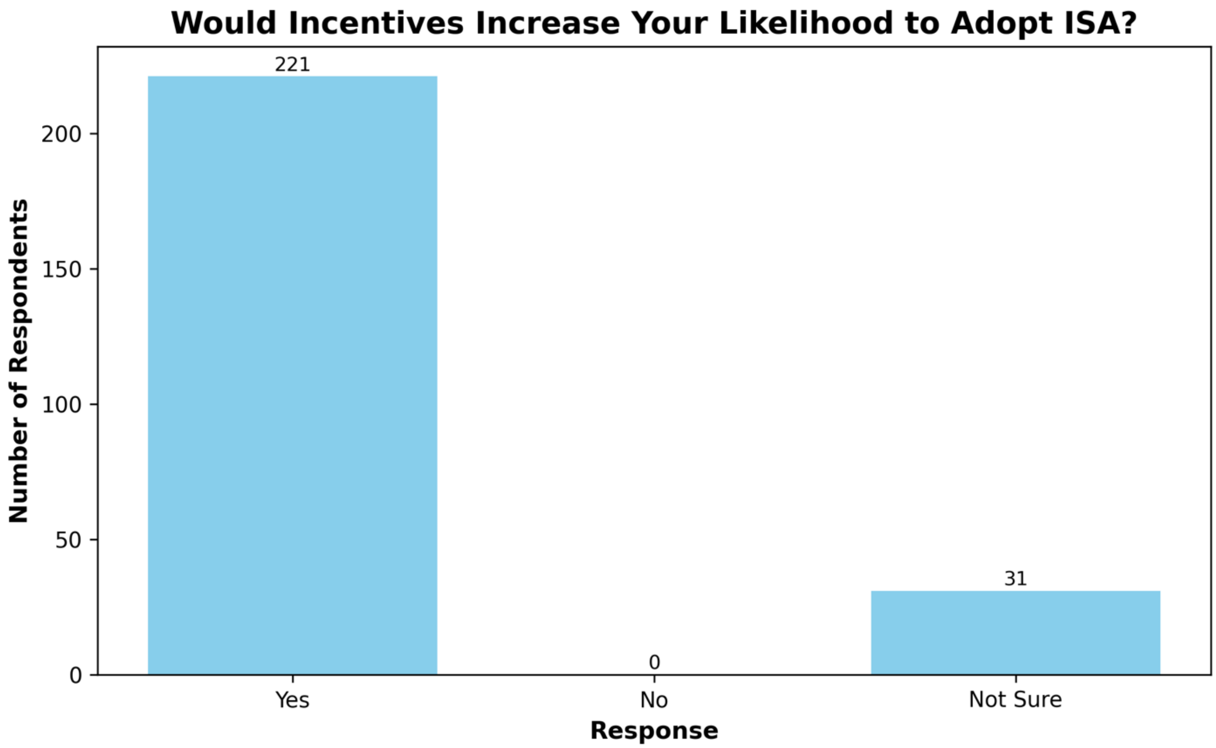
Question 29 asked if ISA systems should be mandatory in all newly manufactured vehicles. As shown in Figure 40, 155 respondents answered "Yes," supporting government-mandated ISA implementation. One hundred and twenty-seven respondents responded with "No" or "Not Sure," indicating resistance to the implementation. These findings imply that even though there is a wide acceptance range from the respondents, there are significant users indicating uncertainty or resistance to the system, revealing concern over enforcement, override abilities, and the perception of driver autonomy.

Figure 40. Responses when Posed with Mandating ISA



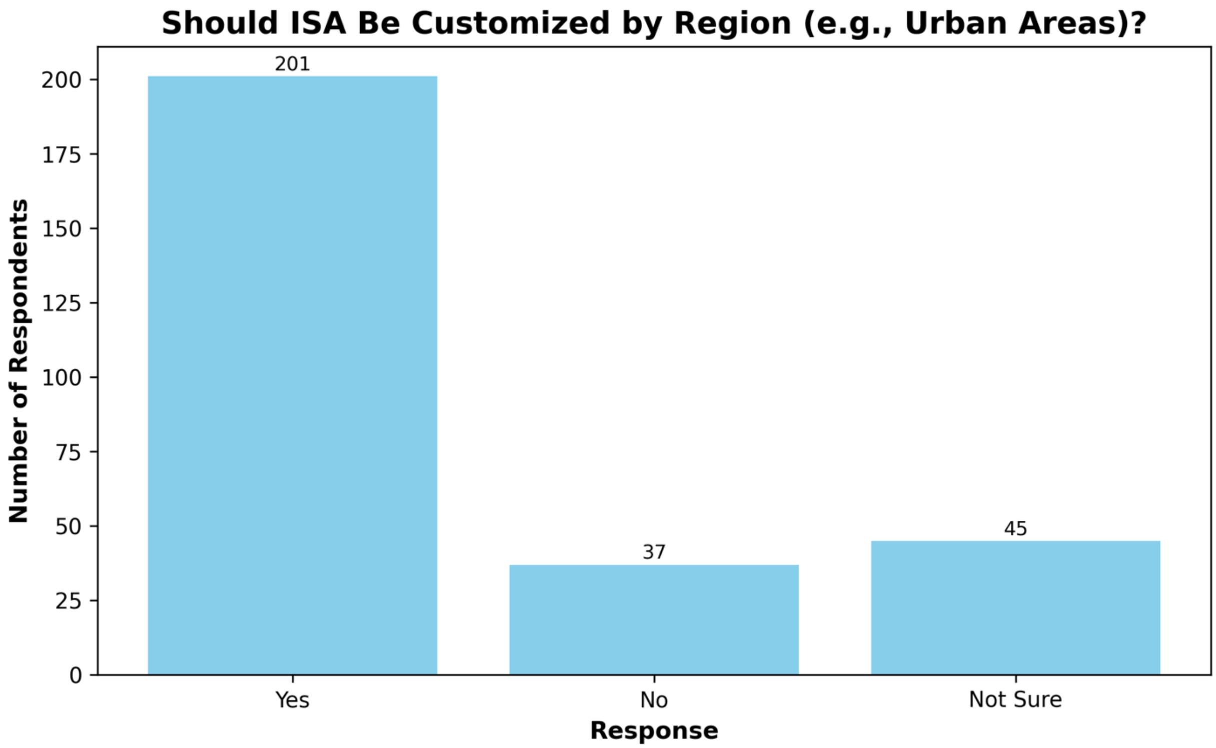
The next question aimed at gaining insight into the respondents' perspectives towards whether incentives—such as insurance discounts or tax credits—would increase the likelihood of ISA adoption. Figure 41 shows that 221 out of 282 respondents indicated that an incentive-based system could play a key role in ISA implementation and adoption. Although "No" was an option, it was not chosen. Thirty-one users selected "Not sure," indicating uncertainty about whether incentives would influence their likelihood of adopting ISA—potentially reflecting ambiguity about the type or value of the incentive rather than indifference toward ISA itself.

Figure 41. Incentives with ISA Implementation



The survey also asked whether ISA systems should be geographically adaptive—for example, applying stricter controls in urban environments compared to rural areas. Figure 42 indicates that the majority of respondents (201 out of 282) agreed that customization by region would be necessary, implying support for ISA system features which allow for flexibility and system adaptability based on road types, traffic patterns, or speed regulations. The results indicated a general favorability among California drivers, in cases where the systems are non-intrusive and adaptable.

Figure 42. Region-Based ISA



4.5.8 Privacy Concerns and Open-Ended Feedback

In the case that ISA technology may collect and process vehicles speed (in real time), GPS data, and driver behavior information, public concerns over privacy and data security were anticipated. The respondents were asked about their concerns surrounding the data collection aspect of ISA systems. Figure 43 shows variability in responses, with 78 respondents being "Very Concerned," 161 "Somewhat Concerned," and 43 "Not Concerned" about ISA data collection. The high level of concern among many respondents may reflect a lack of clear public understanding or transparency around how ISA systems handle and store data, which could be contributing to their apprehension. This indicates the need for system transparency in the cases of ISA system design, development, and data collection for mass implementation. Question 33, shown in Figure 44, asked respondents whether their privacy concerns would affect their willingness to use ISA. The results indicate that for most respondents, willingness would be affected by privacy concerns. For example, 50% of the respondents selected "Yes, Somewhat," indicating a degree of openness to ISA depending on how the user's data is handled. Thirty-three percent of the respondents chose "Yes, Significantly," implying a strong hesitation due to data privacy concerns. Only 17% of the respondents reported "No, Not at All," indicating that this portion of the population is unlikely to be influenced by privacy concerns—either because they do not find such concerns relevant or because they trust the system's data handling.

Figure 43. ISA Data Collection Concerns

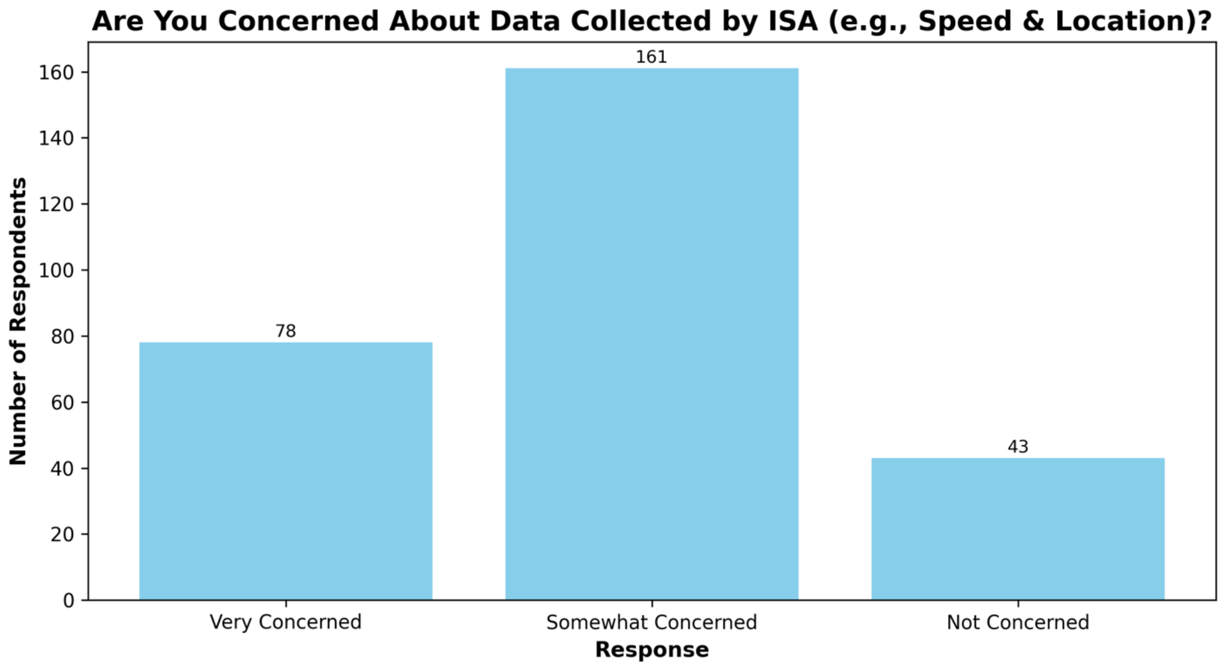
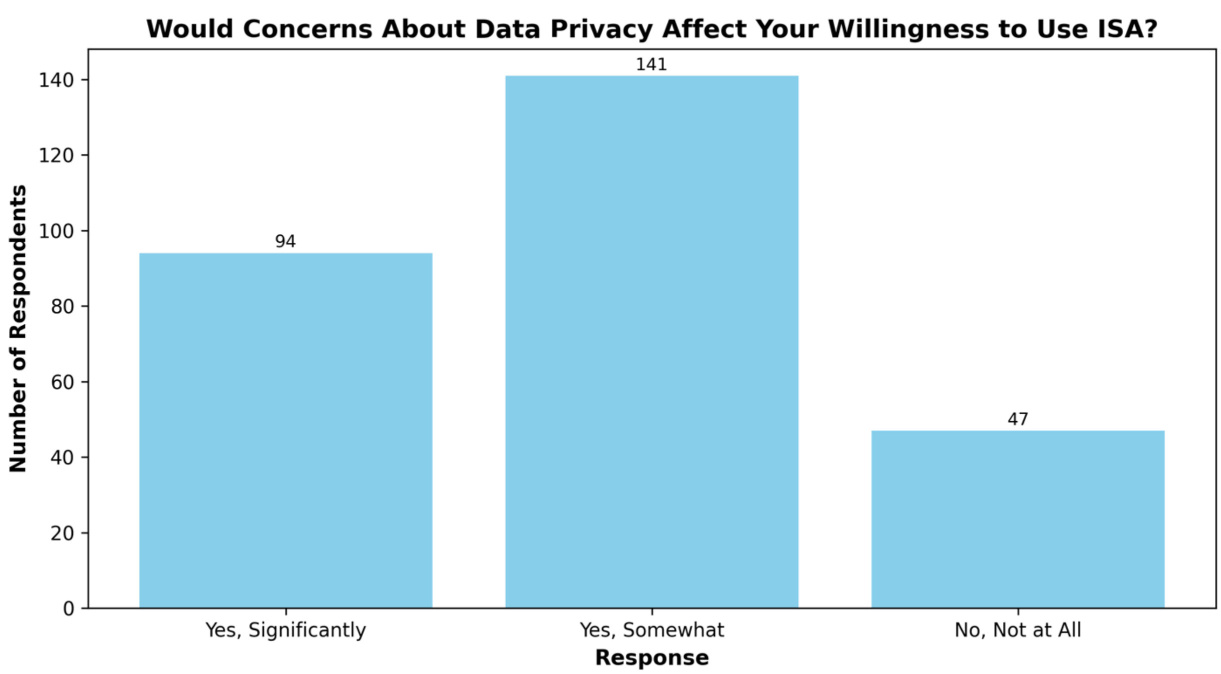


Figure 44. ISA Data Privacy Concerns

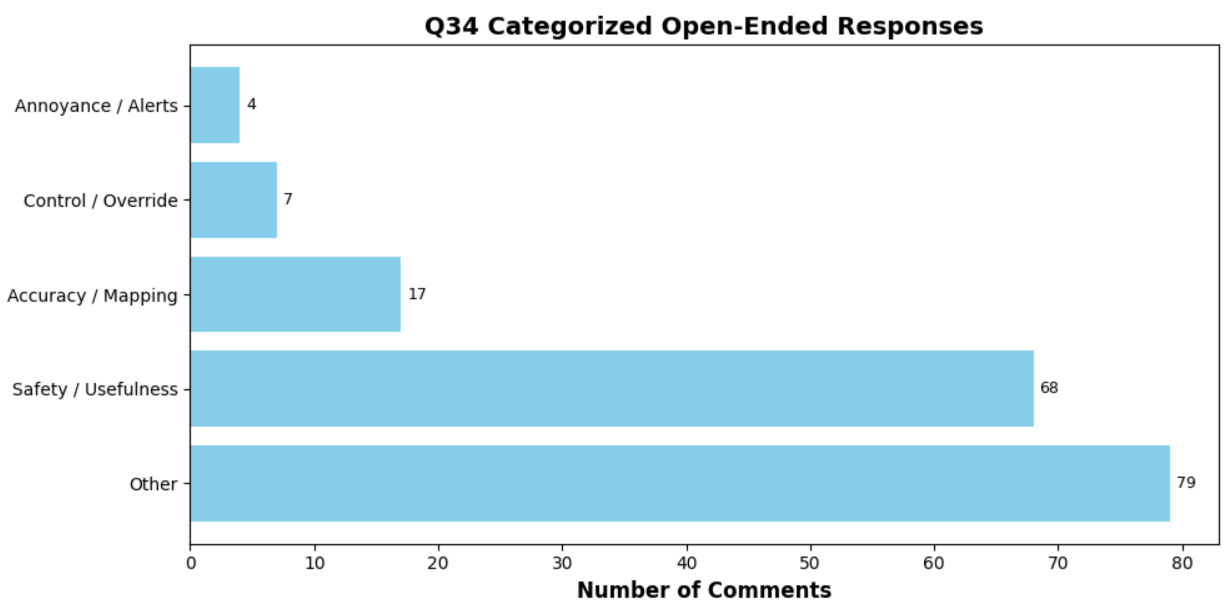


These findings were seen in prior literature regarding ISA deployment, where support for automated enforcement technologies is often dependent upon transparent data policies and strong anonymization protocols. The results emphasize that any future ISA policy in California must integrate privacy boundaries to maintain public trust, especially if speed data is to be leveraged for system optimization or academic evaluation. Privacy concerns form a critical foundation for drivers' trust in ISA systems; therefore, this trust must be earned through transparent data practices and clear communication about how information is collected, used, and protected.

4.5.9 Open-Ended Analysis

To gain personal insight from the respondents, they were invited to share any additional comments, concerns, or suggestions regarding ISA as an open-ended free response prompt. This allowed us to gain insights which may not have been captured through multiple-choice questions/prompts. A total of 112 unique written responses were analyzed using a Python-based natural language processing model and categorized into 5 themes: **Safety/Usefulness, Accuracy/Mapping, Control/Override, Annoyance/Alerts, and Other**. As shown in Figure 45, the majority of responses fall under the Safety/Usefulness and Other categories, with some comments referring to accuracy, user control, or system design.

Figure 45. Open-Ended Analysis



The "Safety" category, comprising of 68 comments, captures responses emphasizing the potential of ISA to enhance traffic safety, reduce fatalities, and improve overall road conditions. One user stated "I believe ISA technology has the potential to enhance roadside safety, but it is crucial to ensure that the systems are reliable and that privacy concerns are addressed. Education on how

ISA works would also be beneficial for drivers." This statement demonstrates strong public support for ISA as a tool to improve safety and improve safety outcomes.

The "Accuracy" category, which was mentioned 17 times, focused on the reliability of the ISA system. Respondents indicated a high-level need for real-time updates to speed limit data and geographical precision. One user stated "In the USA, a key challenge for ISA systems is likely gaining widespread public acceptance, as American drivers often value their autonomy and may resist systems that feel restrictive. Ensuring accurate and consistently updated speed limit data across all regions and accounting for variations will also be crucial for effective implementation." This statement indicates that an accurate data house of speed limits is needed in order to account for potential variance in the road conditions.

Respondents also expressed concerns over the "Control/Override" category, emphasizing the importance of the ability to override the system when conditions are justified to surpass the speed limit. In one case, the user stated "I believe ISA technology has the potential to greatly enhance road safety, but addressing privacy concerns and ensuring the accuracy of the system is crucial for public acceptance. It would also be beneficial for there to be a way to override the system in emergency situations." This statement indicates that an ISA system with override abilities is preferred by the respondents.

The "Annoyance/Alerts" category was represented by 4 comments, raising concern about the effects of over-notifying or unnecessary warnings. Although not significant in numbers, the comments raised concerns that frequent or repetitive ISA alerts could lead to user annoyance or desensitization over time, potentially reducing the system's long-term effectiveness and delaying broader public acceptance.

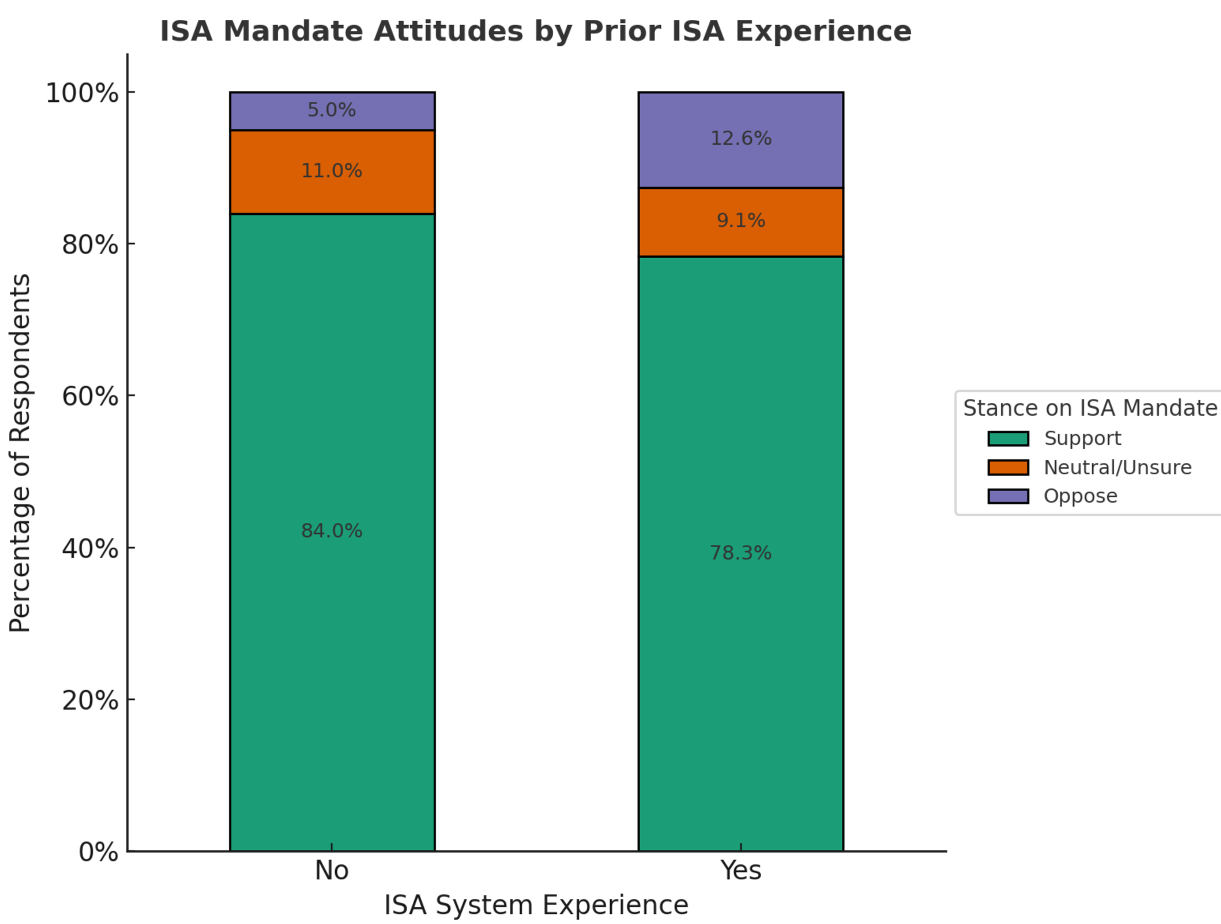
Lastly, 79 comments were classified under the "Other" category, varying in topics from data privacy and integration with other advanced systems in vehicles to nuances in system reliability, other advanced driver-assistance systems (ADAS), and policy concerns. The diversity of responses provided deeper insight into a driver-oriented system, indicating that ISA systems should be designed with a balance of functionality, transparency, and trust. Together, these findings indicate both excitement/enthusiasm and caution surrounding ISA implementation. While many respondents view it as a potential safety tool, concerns around accuracy, control, and alert times must be addressed prior to implementation to allow for easier ISA adoption.

While many respondents expressed support for ISA, agreeing with its potential safety benefits, a notable minority voiced significant concern about the system's implications—more specifically, data privacy, autonomy, and risk of data misuse. Concerns included the possible sharing of information with insurance providers, law enforcement, or third-party services, potentially leading to an increase in insurance costs, negative measures (e.g., citations), or restrictions on driving freedom. One user went so far as to state: "Having my personal data (driving habits) sold to insurance companies and thus increasing insurance costs or denying insurance based on exceeding speed limits is insufferable and inexcusable." This statement indicates a need for clear regulations regarding data use, ownership, and retention. Other comments expressed concerns about overreliance on automation or limiting the driver's control in unpredictable roadway conditions. These concerns once again emphasized a clear need for design transparency, override ability, and implementation strategies to gain the trust of ISA users.

4.5.10 Cross-Analysis of Questions

To dive deeper into the users' perceptions, behavioral responses, and demographic influences related to ISA, a series of cross-question analyses were conducted. These analyses compare responses between key survey variables to examine correlations, contradictions, and support trends. By analyzing intersections across demographic characteristics, ISA experiences, and variances in attitudes, this section provides a multi-dimensional understanding of how drivers evaluate ISA in both conceptual and practical terms.

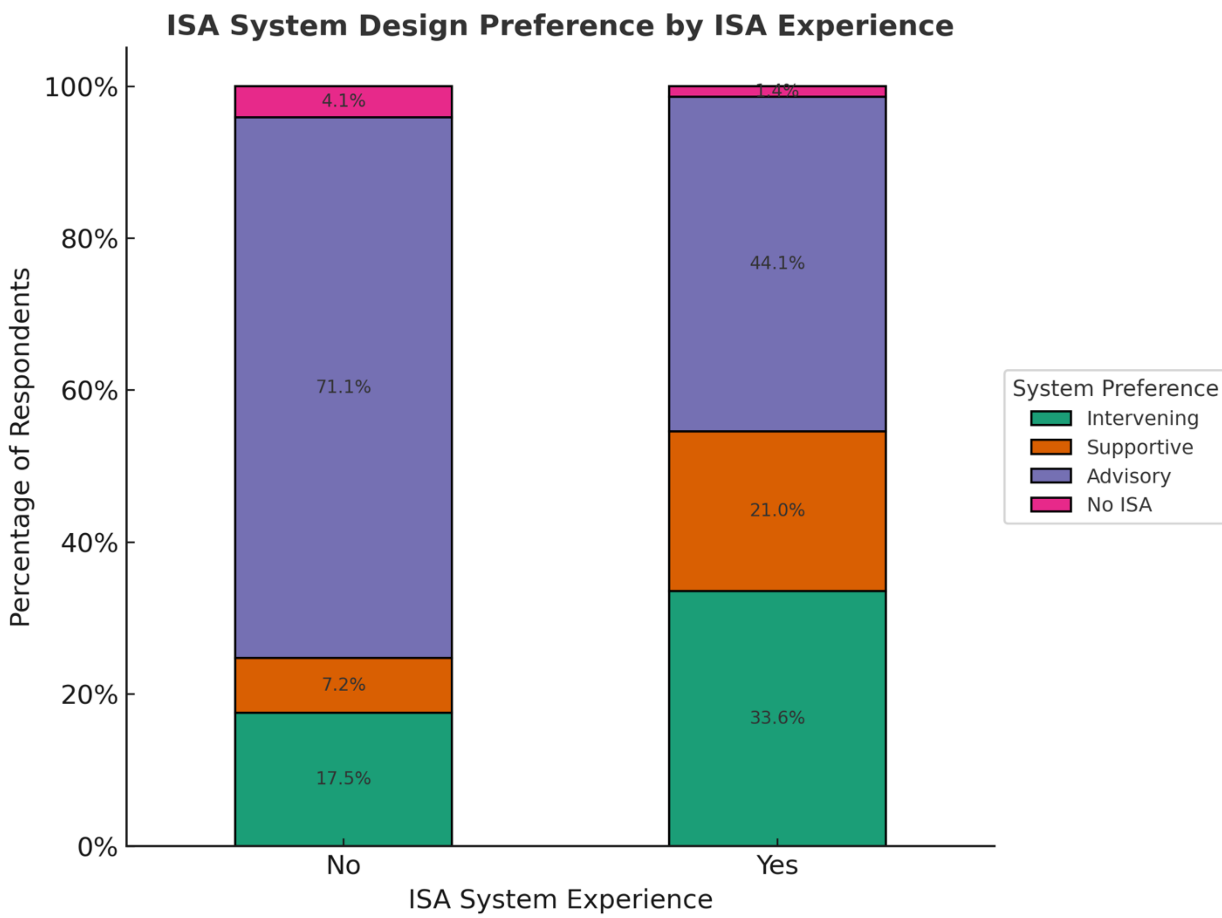
Figure 46. ISA Mandates vs. Experience



One of the distinctions in ISA-related attitudes emerged when comparing support for a government mandate between respondents with and without prior ISA experience. As shown in Figure 46, 78.3% of those with experience supported a mandate, compared to 84.0% of those without experience. Surprisingly, support was slightly higher among those unfamiliar with ISA, possibly reflecting a general openness to safety mandates rather than firsthand confidence.

Importantly, 12.6% of experienced users opposed the mandate, more than double the 5.0% opposition rate among those with no experience. This may reflect disillusionment or specific frustrations learned through use, such as interface limitations or override constraints. The results suggest that real-world exposure not only informs positive perceptions but can also amplify concerns, underscoring the need for transparent communication, adaptable systems, and responsive design to ensure long-term user alignment.

Figure 47. ISA System Preference vs. Experience



A key behavioral insight emerges in Figure 47, which compares ISA system type preferences between experienced and inexperienced users. Among those who had prior experience with ISA, 45.2% favored intervening systems, technologies that actively prevent the driver from exceeding speed limits. In contrast, among respondents without ISA experience, only 28.7% favored intervening designs, with a significant 42.1% instead preferring advisory-only systems, which merely alert drivers when they exceed the limit but do not take actions.

This divergence may reflect how firsthand experience with ISA influences perceptions of control and trust. Drivers unfamiliar with the technology may perceive interventions as intrusive or disruptive, while those who have used it appear to be more accepting of automated enforcement, likely due to a better understanding of its operational boundaries. Importantly, however, 22.5% of all respondents regardless of experience preferred no ISA at all, indicating persistent skepticism in a minority of populations. These findings highlight a central tension in ISA system design, balancing technological effectiveness with driver autonomy, and suggest that phases or customizable system deployment may ease resistance among uninitiated drivers.

Figure 48. ISA Speed Reduction vs. Confidence Impact

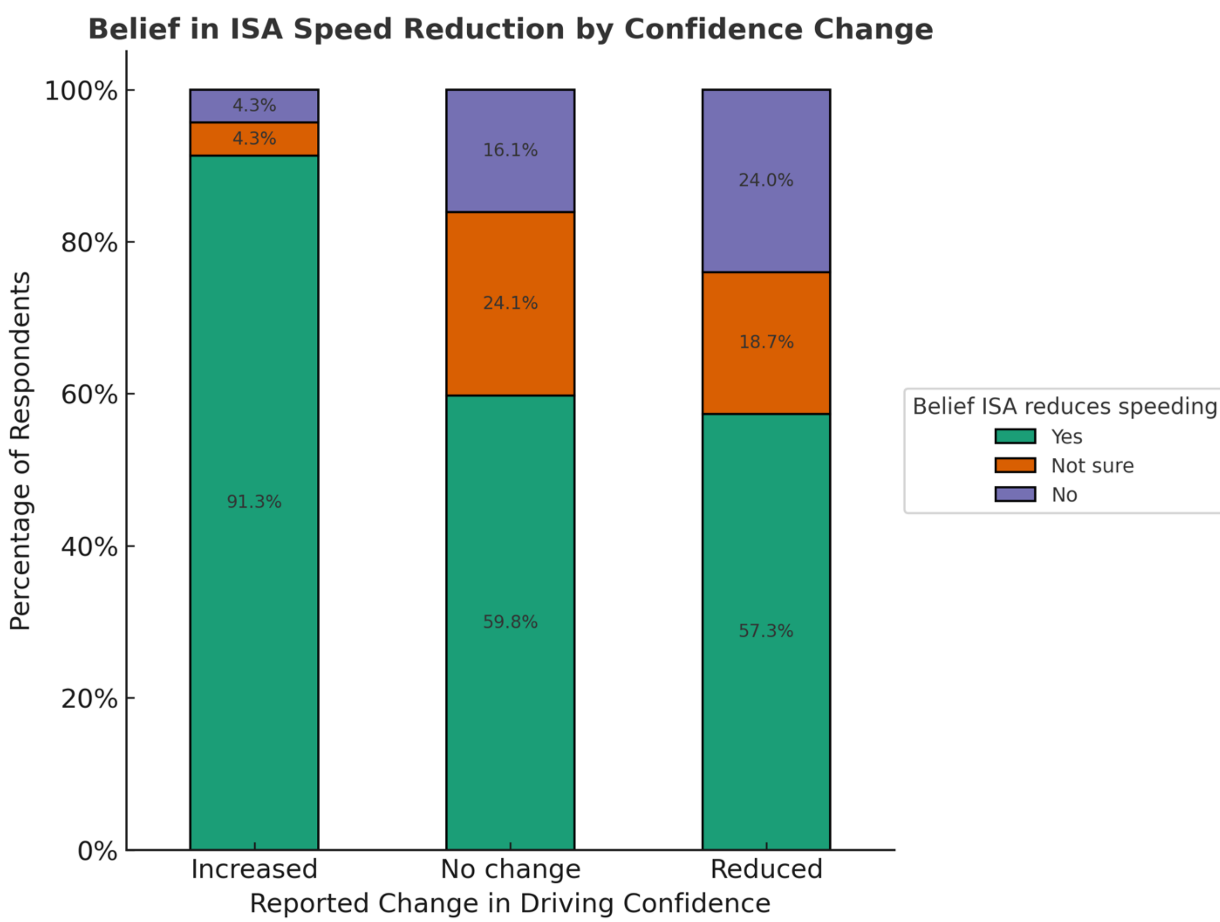


Figure 48 explores the relationship between drivers' reported change in confidence due to ISA and their belief in the system's ability to reduce speeding. Among those who stated that ISA increased their driving confidence, 64.8% also believed that ISA helps reduce speeding, suggesting a clear alignment between personal experience of support and perceived societal benefit. In contrast, respondents who reported no change, or reduced confidence, were less likely to endorse ISA as a speed-reduction tool, with only 39.5% in agreement.

The directionality of this relationship is crucial. While one could infer that ISA boosts confidence by demonstrating real-time safety benefits, it is equally plausible that respondents who already hold favorable attitudes toward automated safety technologies—such as believing they are effective or necessary—are predisposed to view ISA positively and therefore interpret their experience more favorably. Interestingly, even among those who claimed that ISA reduced their confidence, a small subset (16.7%) still acknowledged that it could reduce speeding, suggesting that perceptions of the system's efficacy and user comfort are not always aligned. This disconnect supports the idea that the ISA design must address not only functional effectiveness, but also psychological trust and comfort, especially for drivers with mixed or negative system experiences.

Figure 49. ISA System Type Preference vs. Age Group

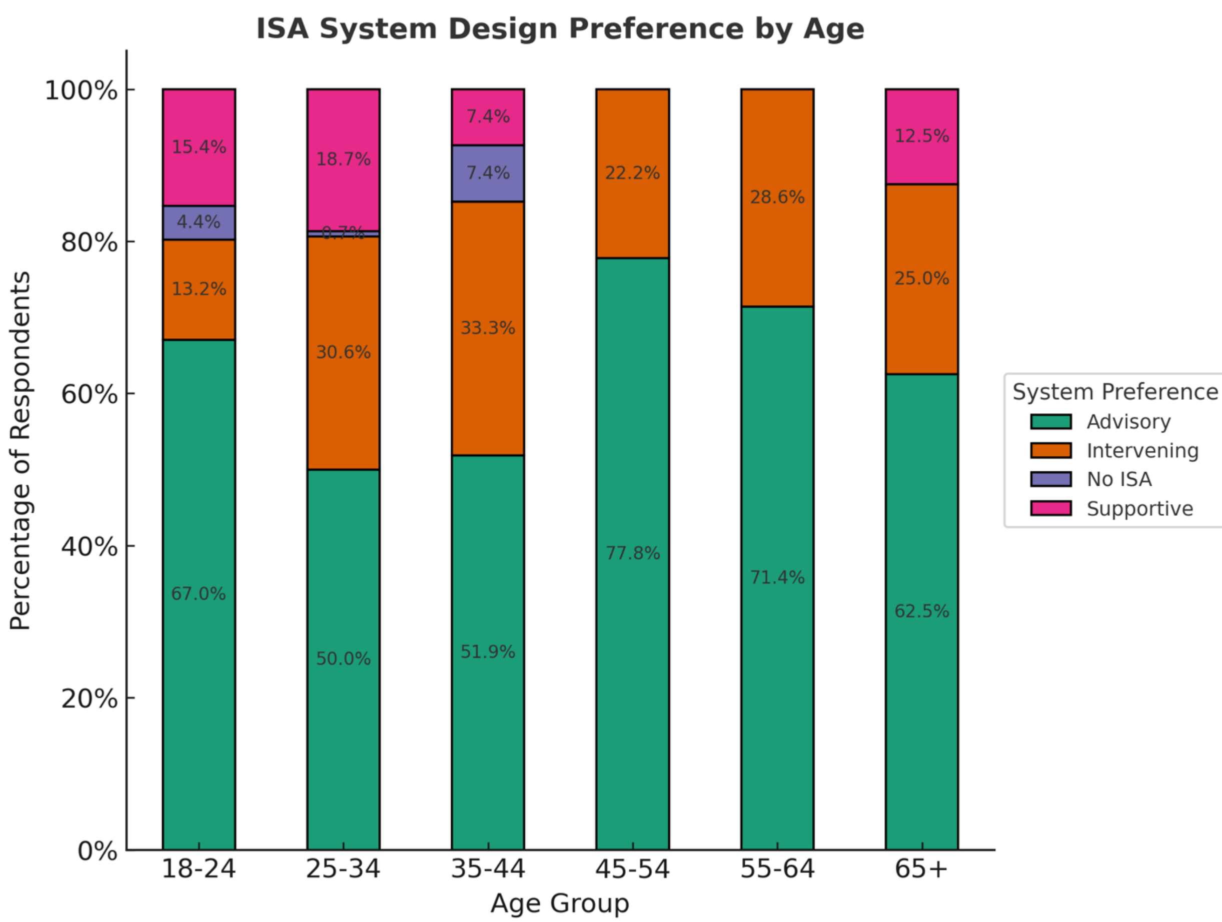


Figure 49 illustrates generational trends in ISA system preferences, revealing a clear shift in attitudes across age groups. Among respondents aged 18–24, 35.7% favored Intervening systems and 25.0% preferred Supportive systems, totaling 60.7% in support of active enforcement technologies. Similarly, those aged 25–34 showed strong endorsement, with 33.3% choosing

Intervening and 22.2% selecting Supportive systems. In contrast, older respondents displayed greater hesitation toward interventionist designs. Among those aged 55–64, 56.3% favored Advisory-Only systems, while only 9.4% supported Intervening designs. The trend was even more pronounced among the 65+ group, where 54.8% preferred Advisory-Only and 23.5% opposed ISA altogether.

This generational divergence suggests differing levels of comfort with vehicle automation. Younger drivers appear more open to automated enforcement, likely due to increased exposure to driver-assistance technologies and growing up in a regulatory driving environment. Conversely, older drivers may view these systems as intrusive or diminishing driver autonomy, even when the safety benefits are clear. These findings underscore the need for age-sensitive ISA design and outreach strategies—such as adjustable enforcement modes or targeted messaging—to broaden acceptance across all age cohorts.

Figure 50. ISA Mandate vs. Gender

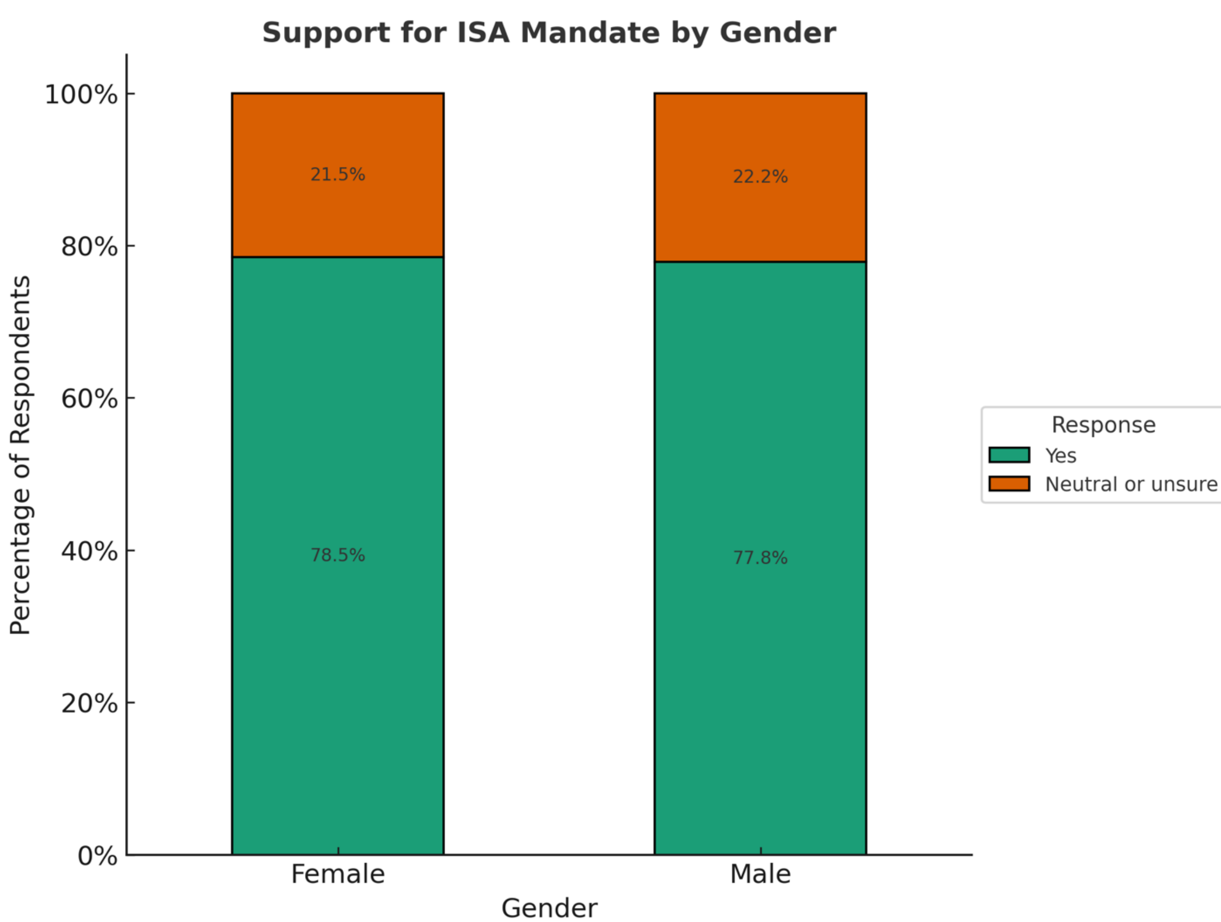
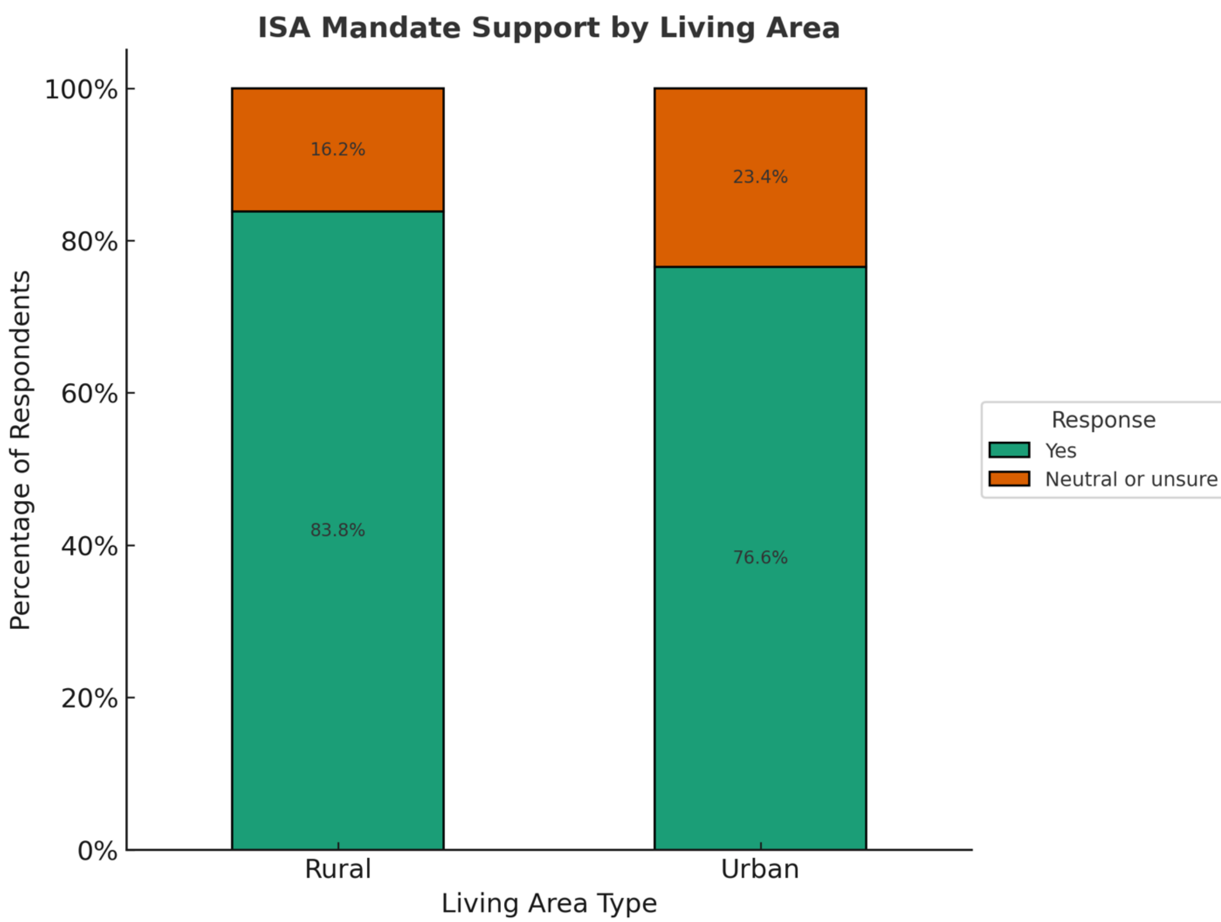


Figure 50 compares male and female respondents' support for an ISA mandate based on survey responses. The results show that 78.5% of women supported mandatory implementation of ISA, closely mirrored by 77.8% of men. The remaining respondents in each group were either neutral or unsure—21.5% among women and 22.2% among men. Notably, no respondents in either group explicitly opposed the mandate, a striking indication of broad-based support across gender lines.

This finding challenges the expectation of a pronounced gender divide in attitudes toward vehicle regulation. Contrary to prior research suggesting that women tend to be more compliant with the speed-limit compared to men (Varet, Apostolidis, & Granié, 2023), the results here show near-identical support levels among men and women. Rather than polarization, the data suggests a shared recognition of the potential safety benefits of ISA systems. While gender messaging strategies may still play a role in communication design, the nearly uniform mandate support implies that broader educational or implementation concerns—such as system transparency or customization—may be more influential in shaping public acceptance than gender alone.

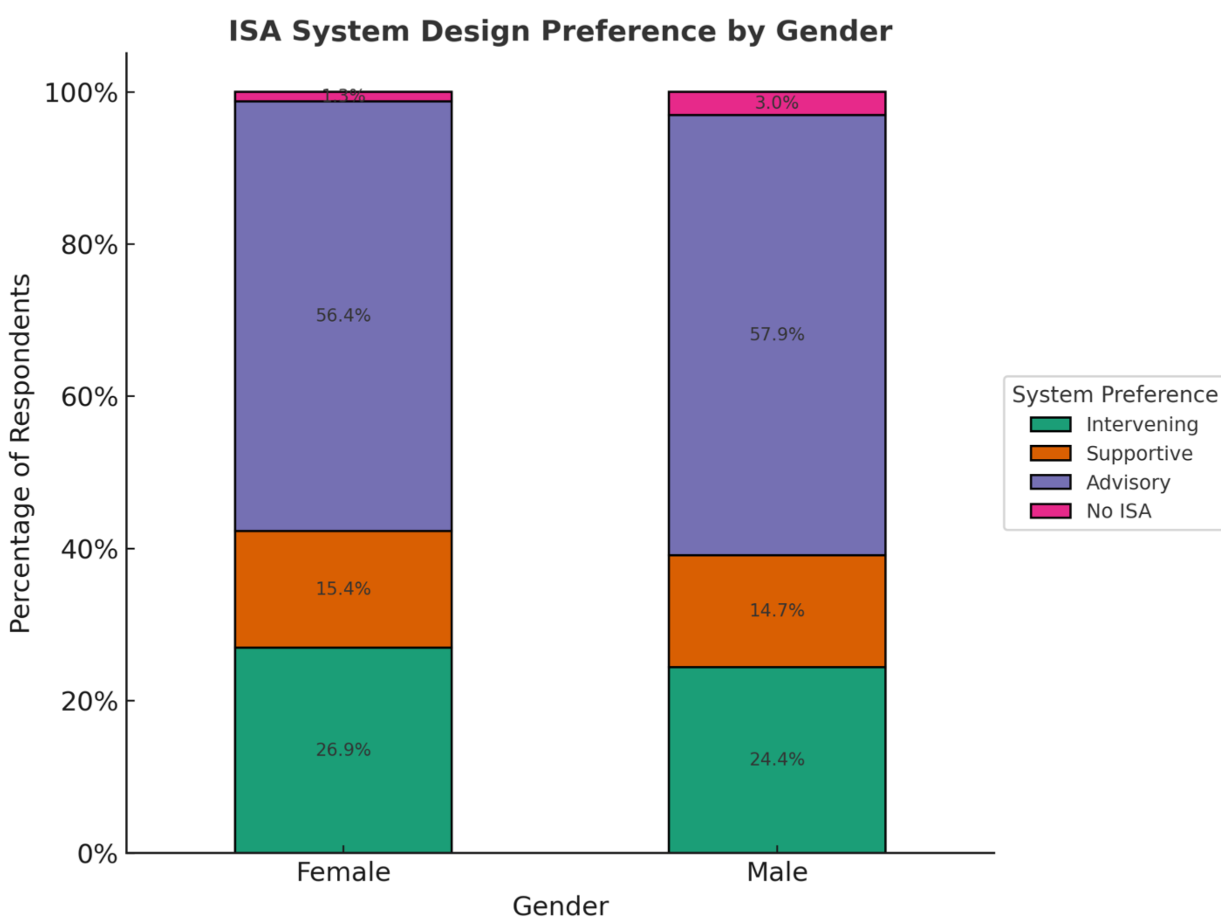
Figure 51. ISA Mandate vs. Living Area



To better understand the regional dynamics of ISA acceptance, a cross-tabulation was conducted between respondents' living environment and their stance on mandatory ISA implementation. As shown in Figure 51, urban residents overwhelmingly supported the mandate, with 96.9% in favor and only 3.1% expressing uncertainty. Support among rural respondents was still high at 83.8%, though a larger share, 16.2%, remained unsure. Notably, no respondents in either group expressed outright opposition to the mandate, highlighting broad-based acceptance across geographic settings.

These patterns suggest that ISA acceptance is influenced not just by technological perceptions but also by infrastructure context. Urban drivers—accustomed to frequent speed signage, enforcement cameras, and variable speed zones—may view ISA as a natural and supportive extension of their environment. Conversely, rural drivers often operate in low-density, open-road conditions where speed control is more self-regulated. In such environments, ISA may be perceived as intrusive or unnecessary. These findings underscore the importance of geographically tailored outreach and implementation strategies: trust in the system must be matched by perceived relevance within the local driving landscape.

Figure 52. ISA System Design Preference vs. Gender



Gender differences in system design preferences are evident in Figure 52. Female respondents were slightly more likely to prefer intervening (26.9%) or supportive systems (15.4%), totaling 42.3%, while male respondents leaned most strongly toward advisory-only designs, with 57.9% choosing visual or audible alerts. Notably, 3.0% of male respondents expressed a preference for no ISA at all, compared to only 1.3% of females.

This gap may reflect differing thresholds for a perceived intrusion versus safety benefit. Prior literature suggests that female drivers are more likely to support in-vehicle safety technologies, possibly due to greater perceived vulnerability or a stronger emphasis on risk reduction (Varet, Apostolidis, & Granié, 2023). In contrast, male drivers may place greater weight on personal autonomy. These findings suggest that ISA rollout strategies should prioritize system customization, user education, and interface transparency to narrow gender-based acceptance gaps and reduce resistance to more assertive configurations.

Taken together, the cross-questions analysis presented in this section illustrated a dynamic interplay between demographic characteristics, experiential familiarity with ISA, and system perception. Key findings indicate that prior ISA users were more likely to support ISA mandates and showed greater comfort with more assertive system types. At the same time, strong demographic patterns emerge, as younger, urban, and female respondents tend to show higher openness to interventionist systems, while rural, older, and male respondents more often express reservations, particularly around mandates and loss of control.

Importantly, not all trends moved in expected directions. Some experienced users still favored non-intervening designs, and certain confident drivers did not attribute their confidence to ISA effectiveness. These internal contradictions underscore the fact that ISA acceptance is not monolithic, but shaped by complex and often competing user beliefs. This reinforces the importance of modular system design, user-centered rollout strategies, and regionally tailored policy framing. These findings here serve as a bridge to the broader discussion, where the behavioral and implementation implications of these patterns are explored in detail.

Some internal inconsistencies were observed in the survey responses. For example, 194 respondents reported having seen advertisements for ISA (Figure 21), while only 187 reported having heard of ISA prior to the survey (Figure 18). This discrepancy may be attributed to how participants interpreted the questions—some may have seen ISA-related content without associating it with the term “ISA” or realizing that it referred to a specific technology. Similarly, while no respondents explicitly opposed ISA mandates in the policy question (Figure 51), 3% of male respondents indicated a preference for “no ISA” in a separate question regarding system type (Figure 52). These inconsistencies may reflect uncertainty, a misunderstanding of technical terminology, or variability in how respondents engaged with nuanced survey language. As such, the results should be interpreted with these cognitive and perceptual factors in mind.

4.6 Discussion and Interpretations

This study's findings offer great insight into drivers' perceptions, behavioral responses, and broader public opinions/concerns surrounding ISA technology, particularly within California's driving population. Interpreting the survey results in light of the existing literature reveals patterns of support and concern and explores practical implications for ISA policy and system design.

Awareness of ISA, while moderately popular, revealed a degree of familiarity across the sample, suggesting that ISA has entered the public knowledge, though it remains misunderstood by most drivers. This aligns with prior research identifying knowledge gaps as a barrier to technology acceptance.

Respondents largely perceive ISA as a tool that could improve road safety and reduce speeding, consistent with the objective outlined in European deployment strategies and U.S. pilot programs. A significant portion indicated that ISA would reduce their tendency to speed, and many acknowledged its potential to decrease driving stress and the risk of receiving tickets. However, the degree of behavioral influence exerted by ISA systems varied by road type, with drivers being more likely to perceive ISA as beneficial on freeways—where speeding behavior was more common—compared to local streets. These findings emphasized the importance of road condition design and calibration of ISA thresholds and alerts.

Despite the support of ISA, hesitancy emerged in areas of system control and data privacy. Open-ended feedback revealed that concerns surrounding loss of control, inaccurate speed limit databases, and the inability to override ISA systems were consistent themes. The responses also revealed heightened concerns about potential misuse of personal data—particularly fears of increased insurance premiums or penalties resulting from speeding-related data. These perspectives align with findings in the literature that identify autonomy and data transparency as a critical acceptance barrier in intelligent vehicle technologies.

The results indicate tension between perceived safety benefits and fear of system malfunctions or overstepping. Some respondents expressed discomfort with relinquishing control to automated systems, while others voiced frustration with the intrusive frequency of alerts or expressed uncertainty of ISA mapping infrastructure. This feedback reinforced the results of the prior literature review and the importance of maintaining user-override functions and ensuring high data accuracy in implementation.

Additionally, ISA preference data revealed a sway towards informative or supportive systems rather than fully intervening ISA systems. Respondents preferred feedback mechanisms that allowed awareness and decision-making without full system intervention, such as visual alerts or haptic feedback. This preference highlights the need for tiered systems designed to allow flexibility, particularly during transitional periods of advanced technology adoption.

The collective results underscore a broader theme: ISA may be effective in shaping safer driver behavior, but its success is dependent on how the systems are relayed, implemented, and regulated by the agencies. Acceptance is not purely a function of technological performance; it is shaped by the perceived fairness, usability, and trust in system governance.

4.7 Limitations

While the findings presented in this study offer valuable insights into public perceptions, behavioral expectations, and policy considerations surrounding ISA systems, several methodological and practical limitations must be acknowledged to contextualize the interpretation of results.

First, the study relied primarily on self-reported data, which is inherently subject to a range of behavioral biases. Respondents may have overreported favorable behaviors (such as compliance with speed limits) or underreported unfavorable attitudes towards surveillance-related technologies. Additionally, variations in individual understanding of technical terminology such as "automatic override" or "supportive feedback" may have influenced response validity despite the questionnaire design.

Second, the sampling approach, while filtered for California-licensed drivers, was executed primarily through Amazon Mechanical Turk (MTurk) and university outreach channels. Although MTurk provides access to a demographically diverse population, the platform may still sway toward younger, more technologically adaptable/literate participants. As a result, the findings may underrepresent perspectives from older adults and non-English speaking drivers, which could limit generalizability across the broader California driving population.

Third, a considerable proportion of participants indicated no prior experience with ISA systems, leading much of the analysis—particularly on useability, override behavior, and policy preference—to reflect anticipated rather than experienced interactions. This distinction limits the extent to which the findings can be applied to real-world ISA adoption scenarios and suggests that familiarity plays a significant role in shaping perception.

Lastly, while the inclusion of an open-ended question gave insight into the user's behavior, the nature of a brief online response constrained the depth of interpretive analysis. This study relied solely on survey-based methods; it lacked the deeper contextual insights that could have been gained through follow-up interviews or observational research. As a result, more layered perspectives on automation ethics, system reliability, and access may not have been fully captured.

5. Recommendations

Drawing on the comprehensive survey's findings, NHTSA dataset analysis, and literature review, the following recommendations are proposed for ISA system developers, transportation policy makers, and future academic researchers seeking to support safe and equitable implementation of ISA technologies.

Design an ISA system to prioritize driver flexibility and override capability

Feedback from the surveyed drivers indicates a clear preference for supportive or informative ISA systems that provide information or resistance without completely overriding drivers. Open-ended comments revealed discomfort with systems that fully restrict the driver's autonomy. To promote acceptance, manufacturers should implement tiered ISA functionality that allows drivers to temporarily override the systems in justifiable scenarios (emergency maneuvers, mismatched speed signage), while logging these actions for future calibrations. System overriders should be recorded and analyzed to improve systems learning without penalizing users. This would allow users to build trust with the system.

Mandate real-time, regionally calibrated speed-limit databases

A major concern highlighted across both the open-ended survey responses and the NHTSA consumer complaints was inaccurate or outdated speed limit data which undermines ISA reliability. To address this, ISA systems must be supported by robust, frequently updated regional databases that account for temporary changes (construction zones, school hours, etc.) and provide local context for decision-making. Legislative support and data sharing partnership with state departments of transportation will be essential.

Integrate privacy-protective mechanisms and clear data governance policies

Public trust in ISA systems hinges on transparent, ethical data practices. Nearly 80% of survey respondents reported at least some concern over data privacy. Systems should avoid real-time transmissions of identifiable data unless anonymized and consent-based. Strong governance structures should clearly define ownership, retention, and permissible uses of collected data. Further, ISA-equipped vehicles should offer users accessible reports indicating what data is being collected and how it is used.

Promote incentive-based adoption programs rather than blanket mandates

Although many survey respondents supported mandatory ISA in newly manufactured vehicles, a significant portion of resistance stemmed from concerns over driver autonomy. Financial incentives, including insurance discounts or registration rebates, may offer a more publicly acceptable adoption pathway, especially for optional or advisory ISA systems. This aligns with findings from prior research that highlight incentives as a key lever in driver behavior change.

Pilot ISA in high-risk area before statewide deployment

Given differences in speed behavior across road types and geographic regions, early ISA deployment should focus on urban corridors and high-speed crash prone zones. These localized pilots can help validate system accuracy, gather driver feedback, and build community support before expanding to broader implementations. Performance results should be made publicly available to foster transparency.

Integrate ISA with other car mechanisms

ISA should not exist in isolation but rather as a part of a comprehensive strategy to reduce roadway fatalities. This includes combining ISA with lane keeping assistance, automated emergency braking, and connected vehicle systems. At the policy level, ISA integration should align with transparency in initiatives and safe system approaches to build a holistic safety culture.

6. Conclusion

This work explored the public acceptance, behavioral influence, technical challenges, and policy landscape surrounding Intelligent Speed Assistance (ISA) systems. By analyzing large-scale national complaint and recall data alongside an original survey of California drivers, the study provides a comprehensive understanding of ISA practical implications in the U.S. context.

Key findings revealed that while awareness of ISA remains moderate, there is significant interest in its safety potential, particularly in high-speed environments such as freeways. Most survey participants believed that ISA would reduce their likelihood of speeding and acknowledged benefits such as lower driving stress and reduce ticketing risk. However, these outcomes reflect self-reported perceptions and may be influenced by individual biases; therefore, they cannot be generalized to the broader population without further empirical validation. However, acceptance of ISA is not unconditional. Concerns regarding driver autonomy, override options, systems accuracy, and data privacy emerged repeatedly across structured responses and open-end feedback.

The NHTSA database analysis reinforced the findings by uncovering persistent issues in real-world ISA-adjacent systems, including throttle control errors, mapping inaccuracies, and override malfunctions, many of which directly impacted safety outcome and driver trust. These results suggest that while ISA is technologically promising, its real-world effectiveness will depend on rigorous data governance, user-centered design, and flexible policy implementation.

All in all, ISA presents a transformative opportunity to reduce speeding related crashes and promote safer road behavior. Yet to fulfill this potential, its deployment must be rooted in public trust, systems transparency, and adaptive policy—not just technological capability. Only through careful calibration of system design, driver input, and institutional responsibility can ISA evolve from promising innovations to public safety standards.

7. Future Work

While this study has contributed a significant foundation to understanding safety implications, public attitudes, and implementation challenges of Intelligent Speed Assistance (ISA) technology in the United States, particularly California, there remain several key areas for future exploration.

Future studies should implement ISA to assess how user attitudes toward ISA evolve over extended periods of system exposure. While this study relied primarily on survey-based anticipation of ISA behavior, tracking users' behavioral shifts and override patterns over six months to a year would allow for a more well-rounded behavioral analysis.

In order to gain direct insight from California drivers, a pilot program should be implemented—especially in high-crash corridors or urban environments. This would provide field data specific to the region's city layout and driver behavior. Public agencies and private fleets could implement the system and allow for data collection on speed compliances, override frequency, and driver satisfaction under real conditions.

Further investigation is needed into optimizing ISA interfaces to balance effectiveness and driver comfort. Experimental work is needed to analyze the benefits and negative effects of various feedback types such as haptic, visual, and auditory. User customization can allow for enhanced results due to diverse environmental conditions.

Further research on ISA as part of Advanced Drives Assistances Systems (ADAS) and connected vehicle technologies should be conducted in order to evaluate the interactions between said systems. Future research should explore the interaction of ISA with autonomous features such as adaptive cruise control, vehicle-to-infrastructure communication, and real-time mapping updates to ensure system reliability and cohesive operation.

Appendix A

Survey Questionnaire

Survey purpose: Thank you for participating in this survey. The purpose of this survey is to gather opinions and perceptions about Intelligent Speed Assistance (ISA), a vehicle technology designed to improve road safety.

Even if you're not familiar with ISA or similar systems, your responses will help us better understand drivers' views.

Section 1: Demographic

1. Do you have a driver's license?

   a. Yes

   b. No

If no, take them out of the survey

2. In what year did you get your driver’s license?

Text Box: Fill in the blank

3. What is your age range?

   a. 18-24
   b. 25-34
   c. 35-44
   d. 45-54
   e. 55-64
   f. 65+

4. What is your gender?

   a. Male

   b. Female

   c. Non-Binary

   d. Prefer not to say

5. What is your race?

   a. White

   b. Black or African American

   c. Asian

   d. Hispanic or Latino

   e. American Indian or Alaska Native

   f. Native Hawaiian or Pacific Islander

g. Other (Please specify)

h. Prefer not to say

6. What type of area do you mostly live in?

a. Urban (city or a highly populated area)

b. Rural

c. Other

7. What type of road do you typically drive on?

a. Mostly highways

b. Mostly local roads

c. Mix of both

Section 2: Awareness and Familiarity

8. Have you heard of Intelligent Speed Assistance (ISA) technology before this survey?

(ISA is a technology designed to help drivers comply with speed limits by providing alerts or automatically limiting speed.)

a. Yes

b. No

9. How familiar are you with ISA systems?

a. Not at all familiar

b. Slightly familiar

c. Moderately familiar

d. Very familiar

10. 10. Where did you learn about ISA technology? (Select all that apply)

a. Television or radio

b. Online news or articles

c. Social media

d. Friends or family

e. Vehicle dealership

f. Personal experience with a vehicle

g. Other (please specify)

11. Do you know if your current vehicle is equipped with any Advanced Driver Assistance Systems (ADAS), including ISA? (e.g., lane assist, adaptive cruise control. ADAS refers to features like automatic braking, lane-keeping assistance, or speed-limit monitoring)

a. Yes

b. No

c. Not applicable (I do not have a personal vehicle)

12. 12. Have you seen advertisements or promotions for vehicles with ISA features? (e.g. in car commercials, or additional systems add-ons)

a. Yes

b. No

Section 3: Perceptions and attitudes

13. 13. Do you believe ISA systems can improve road safety by reducing speeding?

a. Strongly disagree

b. Disagree

c. Neutral

d. Agree

e. Strongly agree

14. What concerns do you have about using ISA technology? Select all that apply

a. Loss of control over vehicle speed

b. Inaccuracy of speed limit data

c. Privacy concerns regarding data collection

d. Increased travel time

e. Distracting alerts or warnings

f. Additional cost of the technology

g. Potential for system malfunction

h. None

i. Other

15. How comfortable would you feel using a vehicle equipped with ISA that actively limits your speed to the posted limit?

a. Very uncomfortable

b. Somewhat uncomfortable

c. Neutral

d. Somewhat comfortable

e. Very comfortable

16. Do you feel that ISA technology intrudes on your driving freedom?

a. Yes

b. No

c. Not sure

Section 4: Experience with ISA

17. Have you ever used a vehicle equipped with ISA or a similar speed-limiting technology?

a. Yes
b. No

18. If yes, how frequently did you use the ISA systems?

a. Always
b. Often
c. Sometimes
d. Rarely
e. Never

19. How would you rate the accuracy of the ISA systems in detecting and responding to speed limits?

a. Very inaccurate
b. Somewhat inaccurate
c. Neutral
d. Somewhat accurate

20. What challenges did you experience while using ISA? Select all that apply

a. Incorrect speed limit detection
b. Delayed response to speed limit changes
c. Difficulty overriding the system when necessary
d. Distracting alerts or warnings
e. System malfunctions or errors
f. No challenges experienced
g. Other

Section 5: Driving habits and behavioral impact

21. When driving on highways/freeways, what is your typical driving speed compared to posted speed limits?

a. I always drive below the speed limit
b. I follow the speed limit closely
c. I often exceed the speed limit slightly (5-10 mph over)
d. I exceed the speed limit more significantly (10-15 mph over)

22. When driving on city/local streets s, what is your typical driving speed compared to posted speed limits?

a. I always drive below the speed limit

b. I follow the speed limit closely
c. I often exceed the speed limit slightly (5-10 mph over)
d. I exceed the speed limit more significantly (10-15 mph over)

23. 23. Do you think using an ISA would influence your driving habits regarding speeding?

a. Yes, I would be less likely to speed
b. No, it would not change my habits
c. Not sure

24. Would ISA make you feel stressed (more or less) while driving?

a. Much more stressed
b. Somewhat more stressed
c. No change in stress levels
d. Somewhat less stressed
e. Much less stressed

25. Do you believe ISA could reduce the likelihood of speeding tickets in your driving experience?

a. Yes
b. No
c. Not sure

26. How do you think ISA systems would affect your driving confidence?

a. Greatly reduce confidence
b. Somewhat reduce confidence
c. No impact
d. Somewhat improve confidence
e. Greatly improve confidence

Section 6: Preferences for ISA features

27. Which type of ISA system would you prefer in your vehicle?

a. Informational: Displays current speed limit without alerts
b. Advisory: Provides alerts when exceeding the speed limit
c. Supportive: Gently reduces speed when over the limit but can be overridden
d. Intervening: Actively prevents speeding without override option

28. What forms of feedback would you find most helpful from an ISA system?
(Select all that apply)

a. Visual alerts (dashboard indicators)
b. Audible alerts (sounds or chimes)

c. Haptic feedback (vibrations in the steering wheel or pedals)

d. Automatic speed adjustment by the vehicle

e. None of the above

f. Other (please specify)

Section 7: Policy and Implementation

29. Do you support making ISA a mandatory feature in all new vehicles sold?

a. Yes

b. No

c. Not sure

30. If incentives such as insurance discounts or tax credits were available, would this make you more likely to adopt an ISA in your vehicle?

a. Yes

b. Not

c. Not sure

31. Do you think ISA systems should be customized to meet the driving conditions of specific regions (e.g., more restrictive in urban vs. Less restrictive in rural areas)?

a. Yes

b. No

c. Not sure

Section 8: Privacy and Data Concerns

32. Are you concerned about data collected by ISA systems, such as speed and location information?

a. Very concerned

b. Somewhat concerned

c. Not concerned

33. Would concerns about data privacy affect your willingness to use ISA technology?

a. Yes, significantly

b. Yes, somewhat

c. No, not at all

34. What additional comments do you have regarding ISA Systems?

Text box: Fill in the blank/Free Response

Bibliography

Adell, E. (2007). Drivers' evaluations of the active accelerator pedal in a real-life trial. *IATSS Research*, *31*(1), https://trid.trb.org/View/813297

Biding, T., & Lind, V. (2002). *Intelligent Speed Adaptation (ISA): Results of large-scale trials in Borlänge, Lidköping, Lund and Umeå during the period 1999–2002*. Vägverket, Butiken.

Blomberg, R. D., et al. (1 Dec. 2015). *Automated feedback to foster safe driving in young drivers: Phase 2*. United States Department of Transportation, National Highway Traffic Safety Administration. DOT HS 812 230, https://rosap.ntl.bts.gov/view/dot/1987

Blum, J. J., et al. (2012). Intelligent Speed Adaptation (ISA). In A. Eskandarian (Ed.), *Handbook of intelligent vehicles* (pp. 581–602). Springer London. https://doi.org/10.1007/978-0-85729-085-4_22

Borowy, I. (Jan. 2013). Road traffic injuries: Social change and development. *Medical History*, *57*(1), 108–38, https://doi.org/10.1017/mdh.2012.83

Brookhuis, K., & de Waard, D. (June 1999). Limiting speed, towards an Intelligent Speed Adapter (ISA). *Transportation Research Part F: Traffic Psychology and Behaviour*, *2*(2), 81–90, https://doi.org/10.1016/S1369-8478(99)00008-X

Carsten, O. M. J., & Tate, F. N. (May 2005). Intelligent Speed Adaptation: Accident savings and cost–benefit analysis. *Acci3dent Analysis & Prevention*, *37*(3), 407–16, https://doi.org/10.1016/j.aap.2004.02.007

Carsten, O., & Ezenwa, A. et al. (2020). *ISA interface study*. Institute for Transport Studies, University of Leeds, 2020.

Carsten, O., & Lai, F. et al. (2008). *Speed limit adherence and its effect on road safety and climate change. Draft final report*. Institute for Transport Studies. University of Leeds.

Creef, K., Wall, J. P., Boland, P., *et al.* (2011). *Road safety benefits of intelligent speed adaptation for Australia.* In *Proceedings of the 2011 Australasian Road Safety Research, Policing and Education Conference* (pp. 1–10).

D'Agostino, M., Cohen, J., Francisco, J., Shaheen, S. A., & Sperling, D. (2021). *California automated vehicle policy strategies.* UC Davis, Policy Institute for Energy, Environment, and the Economy. https://escholarship.org/uc/item/6s59c5b7

De Vos, Bart, et al. (2023). The effectiveness of an Intelligent Speed Assistance system with real-time speeding interventions for truck drivers: A Belgian simulator study. *Sustainability*, *15*(6), https://doi.org/10.3390/su15065226

ETSC. (17 Nov. 2021). *Intelligent Speed Assistance specifications officially published – ETSC*, https://etsc.eu/intelligent-speed-assistance-specifications-officially-published/.

European Commission (2021). *Road safety thematic report – Speeding*. European Road Safety Observatory. 2021.

European Commission: Directorate-General for Mobility and Transport, et al. (2020). *Study on the feasibility, costs and benefits of retrofitting advanced driver assistance to improve road safety – final report*. Publications Office, https://doi.org/10.2832/316686.

Jiménez, F., et al. (Sept. 2012). Adapting ISA system warnings to enhance user acceptance. *Intelligent Speed Adaptation + Construction Projects*, *48*, 37–48, https://doi.org/10.1016/j.aap.2010.05.017

Lai, F., Carsten, O. et al. (Sept. 2012). How much benefit does intelligent speed adaptation deliver: An analysis of its potential contribution to safety and environment. *Accident; Analysis and Prevention*, *48*, 63–72, https://doi.org/10.1016/j.aap.2011.04.011

Lai, F., Hjälmdahl, M., Chorlton, K., & Wiklund, M. (2010). The long-term effect of intelligent speed adaptation on driver behaviour. *Applied Ergonomics, 41*(2), 179–186. https://doi.org/10.1016/j.apergo.2009.03.003

Lai, F., Hjälmdahl, M. et al. (Mar. 2010). The long-term effect of intelligent speed adaptation on driver behaviour. *Special Section: Behavioural Effects and Drive-Vehicle-Environment Modelling in Modern Automotive Systems*, *41*(2), 179–86, https://doi.org/10.1016/j.apergo.2009.03.003

Molin, E., & Bos, G. (May 2014). Car drivers' preferences for ISA policy measures. *European Journal of Transport and Infrastructure Research*, *14*, 143–58, https://doi.org/10.18757/ejtir.2014.14.2.3022

National Highway Traffic Safety Administration. (2024). *Speeding | NHTSA*. https://www.nhtsa.gov/risky-driving/speeding

NHTSA (17 May 2022). *Newly Released Estimates Show Traffic Fatalities Reached a 16-Year High in 2021*, https://www.nhtsa.gov/press-releases/early-estimate-2021-traffic-fatalities

Oei, H. L., & Polak, P. H. (Dec. 2002). Intelligent Speed Adaptation (ISA) and road safety. *IATSS Research*, *26*, , https://doi.org/10.1016/S0386-1112(14)60042-X

Özkan, Ö. et al. (July 2024). Predicting drivers' intentions to voluntarily use Intelligent Speed Assistance systems: An application of the theory of planned behaviour. *Transportation Research Part F: Traffic Psychology and Behaviour*, *104*, 532–43, https://doi.org/10.1016/j.trf.2024.06.003

Peiris, S. et al. (Oct. 2022). Quantifying the foregone benefits of Intelligent Speed Assist due to the limited availability of speed signs across three Australian states. *Sensors*, *22*, 7765, https://doi.org/10.3390/s22207765

Reagan, I. & Cicchino, J. B. (June 2024). *ISA in the USA? The likelihood of U.S. drivers accepting and using Intelligent Speed Assistance*. Social Science Research Network, https://doi.org/10.2139/ssrn.4863077.

Regan, M. A., Triggs, T. J., Young, K. L., *et al.* (2006). *On-road evaluation of intelligent speed adaptation, following distance warning and seatbelt reminder systems: Final results of the TAC SafeCar project.* Monash University Accident Research Centre.

Rowe, R. et al. (Mar. 2021). Understanding intentions to override Intelligent Speed Assistance prior to widespread availability: An application of the theory of planned behaviour. *Accident Analysis & Prevention*, *151*, 105975, https://doi.org/10.1016/j.aap.2021.105975

Singh, R. et al. (2021). Highway 4.0: Digitalization of highways for vulnerable road safety development with intelligent IoT sensors and machine learning. *Safety Science*, *143*. 105407.

Social Determinants of Health (SDH) (2017). *Managing speed*. 17th ed. World Health Organization. https://www.who.int/publications/i/item/managing-speed

SWOV fact sheet: The relation between speed and crashes. (2012). https://api.semanticscholar.org/CorpusID:46495493

Tate, F., Frith, B., Thomas, F., Newsome, M., & Malcolm, L. (2024). *The potential for intelligent speed adaptation (ISA) to assist with road safety* (Research Report 716). NZ Transport Agency Waka Kotahi. https://www.nzta.govt.nz/resources/research/reports/716

Unger, T., & Schubert, A. (2018). *Qualitative assessment of intelligent speed adaptation (ISA) systems.* Dresden University of Technology. https://www.fiaregion1.com/wp-content/uploads/2018/11/08112018_VUFO-study-on-ISA.pdf

Van den Berghe, W. (Jan. 2021). *Road safety thematic report – speeding*. European Road Safety Observatory. https://road-safety.transport.ec.europa.eu/system/files/2021-07/road_safety_thematic_report_speeding.pdf

Vlassenroot, S. et al. (Apr. 2011). What drives the acceptability of Intelligent Speed Assistance (ISA)? *European Journal of Transport and Infrastructure Research*, *11*, 256–73, https://doi.org/10.18757/ejtir.2011.11.2.2925

Varet, F., Apostolidis, T., & Granié, M. A. (2023). Social value, normative features and gender differences associated with speeding and compliance with speed limits. *Journal of Safety Research*, 84, 182–191. https://doi.org/10.1016/j.jsr.2022.10.018

Weber, M. et al. (Feb. 2023). Approach for improved development of advanced driver assistance systems for future smart mobility concepts. *Autonomous Intelligent Systems*, *3*(1), https://doi.org/10.1007/s43684-023-00047-5

Wiener, S. (Sept. 2024). Senator Wiener's first-in-nation bill to require cars to warn speeding drivers heads to the governor." https://sd11.senate.ca.gov/news/senator-wieners-first-nation-bill-require-cars-warn-speeding-drivers-heads-governor.

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